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An integrated management system for the Navy's technical manpower training programs.

Chasse, Robert Leon
George Washington University

AN INTEGRATED MANAGEMENT SYSTEM FOR THE NAVY'S TECHNICAL MANPOWER TRAINING PROGRAMS

CDR Robert L. Chasse, USN

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AN INTEGRATED MANAGEMENT SYSTEM FOR THE NAVY'S TECHNICAL MANPOWER TRAINING PROGRAMS

By

Robert Leon Chasse

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College of the Holy Cross, 1952

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Thesis directed by

Edwin Timbers, Ph.D.

Director of the Navy Graduate

Financial Management Program

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CHAPTER I

INTRODUCTION

> The Navy of the future requires personnel with unexcelled technical, managerial and operational competence to develop, maintain, and be ready to employ the complex weapons systems now on the horizon. In the face of an increasing demand for such competency, officer and enlisted, there is a decreasing supply. Personnel programs fall short of essential goals. The outlook for the future is not bright. Without a new look at the problem, employing what some may think to be radical measures, the situation will worsen. There are innumerable factors which give rise to our present personnel problems. The solution to many of these is outside the control of the Department of the Navy, but that should not lessen our efforts to press for the actions we think essential. For the problems within our control, we will be remiss if we do not give them the highest priority attention.[1]

So stated the "Dillon Report" to the Secretary of Navy on 15 December 1962. The report's statement of personnel problems reflects the importance of the personnel subsystem within the total Navy system. Much effort and funds has been expended since the "Dillon Report" was published to locate, analyze and solve the personnel subsystem problems referred to by the report. The situation, nevertheless, is not much better than it was six years ago. True, many problems have been resolved. Not much overall progress has been made, however, because new

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[1]Department of the Navy, Review of Management of the Department of the Navy (NAVEXOS P-2426A), (Washington: U.S. Government Printing Office, 1963), p. 9.

problems seem to surface as fast as the old or current ones are resolved.

This is not intended to insinuate that the Navy of the past and present has not been effective. Quite the contrary, the Navy has been instrumental in this country's prompt and effective responses to the varied Cold War requirements including strategic nuclear deterrents.[2] But our Navy of today and tomorrow must not be complacent because of past successes. Rather, it must respond to the changing tempo with a strengthened capability for an even higher proportion of future successes. This cannot be achieved by retaining "buggy-whip" management philosophies.

The increasing complexity in weapons and equipment, caused largely by the greater use of electronics and automation and approaching "push-button" warfare, has exerted pressure for more and better maintenance personnel. The forces which render obsolete the traditional management methods also raise new problems in the management of this country's most priceless resource-- the human being.[3]

In addition, the demands of the continuing cold- and warm-war environment and weapons complexity exert forceful pressures and demands for economy. While responsive support of these de-

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[2]Ibid., p. 2.

[3]Ibid., p. 3.

mands must take the form of the most modern, reliable, and effective weapons this country can produce and manned by competent personnel, we must be mindful of the continuing high inpact of the defense budget on the economy of the country. The American taxpayer can afford no less than the best management of the large share of his income that is taken to pay for his defense.[4]

This thesis examines one particular element of the Navy's overall approach to provide our customer, the American taxpayer, with an effective Navy at minimum cost. This particular element is the Navy's technical manpower training programs, the sine qua non of its effectiveness and, to a lesser degree, its efficiency.

Statement of the Problem

Man is no longer solely a user of military hardware systems; he is an integral part of them. Man has become the vital and often limiting component of the man-machine system. Within the Navy, post-World War II emphasis in the RDT&E process has been on hardware. Other factors of system development, particularly the human factor, have often received only marginal attention and minimal support.[5]

This overemphasis on hardware has both immediate and long-range implications on the effectiveness of

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[4]Ibid., p. 4.

[5]Ibid., p. 98.

> our combat forces. As for today's problems, one need only compare the results of the Polaris Program (a total system effort) with hardware oriented efforts. The success of the Polaris Program can be attributed in a large measure to the inclusion of all subsystems --including the human subsystem-- in the total "Special Project" effort.[6]

The basic question to be discussed is a logical follow-on to the above statement. An examination of the Polaris Training Program and its management should indicate the reasons behind the stated success of this particular aspect of the Polaris Program. The assessment of the effectiveness of the management systems utilized in the Navy's Fleet Ballistic Missile Weapons System Training Program and whether the program can be improved is the fundamental question to be examined.

The discussion of this basic question requires the examination of several subsidiary questions, namely:

1. What management techniques does the Navy's FBM Weapons Systems Technical Manpower Training Program utilize?

2. What levels of effectiveness and efficiency have been realized in this program with the present management techniques?

3. How and in what areas could these management techniques be improved in order to produce the same or a better product at less cost?

4. How effective and efficient is the teaching aspect of the training program and could it be improved?

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[6] <u>Ibid</u>.

5. Can an integrated Technical Manpower Training Program Management System be developed to meet the objectives of the Navy's FBM Program?

6. Could other Navy Technical Manpower Training Programs utilize such an integrated system?

These questions are broad in scope but must be considered in order that a valid training program can be developed. Past and present training programs must be examined in order to determine their validity. The valid components of this training program can thus be included in a "total training system" designed to meet the Navy's present and future training requirements.

The Hypothesis

The hypothesis of this study is that the Polaris Training Program's high level of effectiveness is due, primarily, to the high priority for men, materials and funds enjoyed by the entire Polaris program and to the caliber and dedication of the personnel involved in the program. The management system employed to plan, implement, control and evaluate this training program has not been the primary reason for the program's effectiveness. In many cases, the management system failed to recognize and implement procedures designed to improve efficiency. Program effectiveness could deteriorate unless new training and management concepts are implemented and utilized properly.

Method of Presentation

Three basic areas of manpower training are considered in this study. The first is the organizational structure established to plan, implement, control and evaluate the Polaris Training Program. The second is an examination of the management information systems being used to assist the program managers. The third is a look at the training itself with the intention of forcing a reevaluation of the Polaris training philosophy. Although the problem centers on the integration of these three areas using a systems approach, it is necessary to understand the implications of each.

Chapter II is devoted to a brief history of the Polaris Program and the basic purpose of the program. Chapter III focuses on the beginning of the Polaris Training Program and the development of an FBM Training philosophy. Chapter IV examines the effects of the Dillon Report on technical training. It also examines the management information systems available and in use by the program managers. Chapter V considers an efficiency criteria for Polaris training courses and proposes a "Technology of Training" to improve this efficiency criteria. Chapter VI examines a proposed Polaris Technical Manpower Training Program and its possible application to other technical training programs. Conclusions and overall recommendations are contained in Chapter VII.

Limitations

The scope of this study is limited primarily to the training activities associated with the Polaris program. Other training activities are introduced briefly to reinforce certain concepts or to demonstrate the applicability of the situation or solutions.

No substantial attempt is made to examine the human element as it reacts to a training situation. The motivational aspects of learning are only considered briefly because the human factors involved are too complex and manifold for proper treatment in this study.

Comments on equipment and system design are excluded. It must be recognized, however, that equipment and system designs play an important role in the functional reliability of a weapons system. Clearly, there is much the designer can do to simplify the task of the equipment operator/maintenance technician and, as a consequence, simplify the training task. It should be clear that training itself is merely one sub-system among several which contributes to the overall effectiveness of a weapons system.

The author has endeavored to steer clear of the complex and controversial questions relating to the increase or decrease in the use of NEC's, Pro-pay and Variable Reenlistment Bonuses. These factors can have a substantial effect on a training program and present a fertile area for further investigation.

The discussion is limited to the Polaris Weapons System Training Program which includes the Navigation, Fire Control, Missile and Guidance, and Launching subsystems. It is recognized that this is only part of the total training package required by the FBM system. The exclusion of the other training programs within the FBM system is not meant to indicate that these other programs are of lesser importance but is due to the limited scope of this study.

CHAPTER II

BACKGROUND

The Fleet Ballistic Missile Program - A Short History

In order to understand better the discussions that will follow concerning the Fleet Ballistic Missile (FBM) Training Program, a short review of the history of the FBM program is deemed appropriate. Only the more significant highlights of the program and its development will be mentioned. These highlights, however, should indicate the tremendous complexity of the machine aspect of this man-machine system. It will then be apparent that a properly trained man is required in order to realize the degree of effectiveness needed by this man-machine system.

During the winter of 1955, a special committee working for the National Security Council and headed by Dr James R. Killian, completed a survey of the East-West power balance and handed its report to President Eisenhower. Although it was never made public, the essence of the report was that the Soviet Union was rapidly overtaking the United States in overall strategic power. Three of the committee's principal recommendations called for immediate action to meet the growing Russian missile threat. Specifically, these recommendations were:[1]

1. Further acceleration of work by the Air Force on the

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[1]J. Baar and W.E. Howard, Polaris, (New York: Harcourt, Bruce and Co., 1960), p. 17.

Atlas ICBM.

2. Development by the Army of a 1,500 mile intermediate-range ballistic missile - an IRBM.

3. The parallel development of an IRBM that could be launched from ships at sea.

It was not until 13 September 1955, that the President decided to implement the recommendations of the Killian Report. Progress on recommendation number three was slow primarily because the Defense Department was hesitant in authorizing the Navy to proceed with the development of a sea-launched IRBM. Many people in DOD and in the Navy doubted the practicality of a liquid-fueled missile on ships. No satisfactory solid rocket fuel was available at the time and a liquid-fueled missile was considered extremely dangerous in a shipboard environment. Because of this inherent danger, development work was practically at a standstill.

However, in early December 1955, the Navy made probably the most important single decision involving the fleet ballistic missile--it selected a man to create it in the person of Rear Admiral William F. "Red" Raborn. Admiral Raborn received his "hunting license" in the form of a letter from the Secretary of the Navy and the Chief of Naval Operations. This letter granted him extraordinary authority in the development of an FBM capability.

Thus, on 8 December 1955, the Special Projects Office was created when Admiral Raborn opened his small office in an old

building behind the Main Navy Building in Washington, D.C. He assembled a staff with proven technical and administrative capabilities and embarked on a development and production program unparalleled in American peacetime history.

In the late summer of 1956, two technological breakthroughs occurred which changed the entire complex of the Navy's program. The Special Projects Office received word from the Atomic Energy Commission that a big reduction in the size of nuclear warheads was possible. This, in turn, reduced the size of the IRBM missile required. It was also determined that a small solid-fuel -propelled ballistic missile was feasible. On 8 December 1956, the Secretary of Defense, after being convinced by Admiral Raborn, ordered the Navy to discontinue its work on the liquid fueled missile and to concentrate its efforts in the development of the solid-fueled Polaris.[2] The original estimate for the completion of the first operational system was 1965. Shortly after the Polaris concept was approved, however, the estimate was revised to 1963.

The advent of Sputnik on 4 October 1957 generated a much greater urgency in the United States missile and space program. The acceptance of some compromises in the final system capabilities made it possible to reduce the 1963 operational date of Polaris by three years to December 1960. This decision made it necessary to reduce development time wherever possible.

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[2]Ibid., p. 72.

A missile with a 1200 nautical-mile range would be used instead of the originally planned 1500. The design of the entire system would have to utilize less of the more sophisticated components originally planned and rely more on components within the capabilities of the present "state of the art". The first submarines would have to be of an existing design modified by adding a 130-foot missile compartment section to the hull in order to permit submarine construction to start in January 1958.

Many problems were encountered during the following months and years. The top military/civilian management team assembled and guided by Admiral Raborn, maintained a constant pressure on thousands of contractors. Success was achieved on 15 November 1960, when the USS George Washington, SSBN 598, departed Charleston, South Carolina, for the first operational patrol with sixteen Polaris A-1 missiles on board beating the scheduled date by over a month. Other highlights of the program in chronological order are as follows:

11 January 1958 - First Polaris test flight, Point Mugu, California.

23 June 1958 - First FBM Submarine, the USS George Washington, SSBN 598, launched at Groton, Connecticut.

7 January 1960 - First inertially guided Polaris test vehicle flight fully successful at Cape Canaveral, Florida.

14 April 1960 - First successful underwater launch of a Polaris test vehicle at San Clemente Island, California.

20 July 1960 - First launch of a Polaris test vehicle from USS George Washington while submerged off Cape Canaveral.

15 November 1960 - USS George Washington begins the first Polaris deterrent patrol.

22 November 1960 - First submarine, USS Ethan Allen, SSBN 608, designed from the keel up as an FBM submarine, launched at Groton, Connecticut.

23 October 1961 - First successful firing of the 1500 nautical mile Polaris A-2 missile by the USS Ethan Allen off the Florida coast.

6 May 1962 - Ethan Allen successfully fires and detonates Polaris missile with a nuclear warhead while cruising in the Pacific Ocean.

26 October 1963 - First launching of a Polaris 2500 nautical mile range A-3 missile by USS Andrew Jackson, SSBN 619, off the Florida coast.[3]

25 December 1964 - USS Daniel Boone, SSBN 629, begins the first Pacific Polaris patrol making the FBM weapon system a truly global deterrent.

18 January 1965 - President Johnson announces decision to develop a new missile for the FBM Weapons System,

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[3]Department of the Navy, The Naval Fleet Ballistic Missile Training Program, (Washington: U.S. Government Printing Office, 1964), p. 6.

the Poseidon.

3 October 1967 - USS Will Rogers, SSBN 659, last of the 41 authorized FBM submarines, departs on her first operational patrol.

During this period of time, from late 1955 to late 1967, over twelve billion dollars was authorized for the program, 41 nuclear powered SSBN submarines were built and deployed at an average cost of over 106 million dollars each, five Polaris tenders were built (one converted and four built from the keel up) to support the submarines at deployed sites, four Polaris weapons training facilities, at a cost of 338 million dollars, were constructed to train the personnel needed to man the ships and activities associated with the program and two logistic support centers were constructed.[4] Each of the 41 SSBN's has undergone a Demonstration and Shakedown Operation (DASO) off Cape Kennedy during which each SSBN was qualified to fire tactical missiles (less warhead) prior to beginning its initial operational patrol. The DASO results to date (late 1967) are as follows:[5]

A-1 missile - 21 successful out of 36 attempts

A-2 missile - 38 successful out of 43 attempts

A-3 missile - 55 successful out of 51 attempts

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[4]Department of the Navy, Special Projects Office, Polaris/ Poseidon Fact Sheet, (Washington: Special Projects Office, 1 September 1967). p. 9.

[5]Ibid.

These results are as good and, for the most part, better than obtained with any of the other deterrent missile systems in the United States arsenal.

Thus, a system went from the drawing board to a highly realiable and effective deterrent system in four years and was completed in less than twelve years. When development work began in 1956, the only part of the FBM system that was a reality was the nuclear powered submarine. The other parts of the system, in many instances, existed only as an idea. Research and development work had to be undertaken into areas of technology such as solid fuel rockets, small inertial guidance systems for missiles, advanced ship navigation systems and underwater missile launching techniques where little was known at the time.

The Special Projects Office, with the assistance of advanced management systems such as PERT, was able to coordinate the efforts of a vast Navy-Industry team so that a deterrent system was deployed five years ahead of the original target date. The same team has maintained a high and productive level of effort and has constantly improved the capability and reliability of the system as can be seen from the DASO firing statistics mentioned previously. Their past, present and future achievements will certainly go down in history as one of the most remarkable accomplishments of the modern era.

One of the unique features of the FBM submarine program is that each of the 41 submarines has two complete and inter-

changeable crews, called "Blue" and "Gold". While one crew operates the submarine on its regular cycle of two-month deterrent patrols, the other crew is back at its home port. The first month after returning from patrol is usually spent getting reacquainted with the world after their two-month submerged patrol. Then they undergo a refresher training period prior to undertaking their next patrol. The following chart indicates how the crews are interchanged in a constant cycle:[6]

"BLUE" and "GOLD"

CREW CYCLE*

Duration	Blue Crew	Gold Crew
60 days	Patrol	Refresher Training
30 days	Leave	Submarine Upkeep
60 days	Refresher Training	Patrol
30 days	Submarine Upkeep	Leave
60 days	Patrol	Refresher Training

*Approximate

This two-crew system was adopted in order to accomplish several objectives. Most important, it permits the submarine to remain at its forward operating site without having to return to the United States to provide the crew with a rest period. This allows the submarine to be kept on patrol in a full deterrent posture for two-thirds of its operational lifetime thereby

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[6]Department of the Navy, Bureau of Naval Personnel, Recruiting Aids Division, Polaris - Missiles and Men, (Washington: RAD, 1 July 1967), p. 17.

accomplishing the same level of deterrance with fewer submarines.

It also provides a "refresher training" period for each crew in order to maintain the crews' proficiency and to update their knowledge required by the constant refinements and modifications being made to equipment and operating procedure.[7] These refresher training sites are located at each of the three FBM submarine home ports, namely, New London, Connecticut; Charleston, South Carolina; and Pearl Harbor, Hawaii. The location of these sites at the crew's homeport permits the "off-crew" to live at home during their refresher training period, a definite morale factor.

Purpose of the FBM Program

The Polaris man-machine-missile system was designed for one purpose only-- the prevention of nuclear war. The FBM weapon system is the Navy's major contribution to the United States mix of strategic deterrent weapons. Hidden, mobile, ready and little noticed by the world at large, a growing fleet of nuclear powered FBM submarines, each carrying sixteen nuclear tipped Polaris missiles, has, since 15 November 1960, roamed the oceans of the world assuring any potential enemy that should he launch a nuclear attack on this country, he would receive a crippling nuclear blow in response. Each of the now completed fleet of 41 submarines carries more destructive power within its hull than all that unleashed throughout World War II.

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[7] *Ibid.*, p. 18.

Prevention of war may seem an unusual mission for submarines, but in the age of the ICBM, unusual strategies are necessary. The FBM system has been highly effective in the implementation of this "strategy of deterrence". A "war deterrent" is effective only if the enemy is convinced of its ability to retaliate. The nuclear powered FBM submarine with its capability to roam anywhere in the world's oceans, can bring any target on earth within range of its sixteen missiles. This mobility and its ability to hide under the ocean curtain for months at a time, makes it practically impossible for the enemy to locate and destroy this force. The range, secrecy and mobility of the submarine also complicates the enemy's defensive problem by denying him the information of the direction from which a retaliatory strike would come.

The Polaris program has been a sparkling success to date. No patrol has ever been aborted due to failure of the system which includes the missiles, submarine and the crew. The missiles have a high record of reliability and dependibility. All sixteen missiles on each submarine on patrol have been ready for firing more than 98 per cent of the time with fifteen missiles being ready 99.9 per cent of the time.[8] It is the only missile system in the United States arsenal that has been fully tested including the detonation of a nuclear warhead delivered by an operational system aboard a submarine. In addition, in over 500 patrols since

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[8]H.W. Baldwin, "Poseidon - New Chapter in Missilery", Reader's Digest, (February, 1968), p. 123.

1960, no Polaris submarine - once submerged on a combat patrol--has, as far as can be ascertained, ever been detected, much less tracked, by the Russians.[9]

The system has been continually improved since 1960. The first five submarines (598 class) carried the first generation Polaris A-1 missile on operational patrols. All five have since been returned to the United States, refitted to carry the longer range Polaris A-3 missiles, and have returned to their operational areas. Overhauls are underway for the five 608 class SSBN's which carry and will retain the Polaris A-2 missiles. 34 FBM submarines with 336 A-3 and 208 A-2 missiles are assigned to the Atlantic Fleet and seven FBM submarines with 112 A-3's are assigned to the Pacific Fleet.[10]

Starting in 1969, 31 of the FBM submarines will be converted to C-3 or Poseidon missile capability while the remaining ten will retain A-3 missiles. Poseidon will have double the payload of the Polaris A-3, be twice as accurate and have improved ability to penetrate enemy defenses giving it an effectiveness about eight times greater than that of Polaris. The increased capabilities of the Poseidon in addition to the inherent survivability of its launching platform, the nuclear-powered submarine, provides ample testimony to the fact that the FBM Weapons System will

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[9] Ibid.

[10] Polaris/Poseidon Fact Sheet, op. cit., p. 1.

continue to be a reliable and credible retaliatory force for this country for many years in the future.[11]

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[11] *Ibid.*, p. 7.

CHAPTER III

THE FBM WEAPONS SYSTEM TRAINING PROGRAM

The Beginning of the Training Program

The concept of a force of FBM submarines and their operating tactics was to be quite different than the traditional submarine tactics of actively seeking and engaging the enemy in combat. The ships were to avoid all contact, friendly or otherwise, in order to protect their secrecy while on patrol. In addition, the sophistication, complexity, and destructive potential of each of these submarines would require personnel trained and conditioned to cope with this unusual environment. It was clear that a special breed of men would be required to transform the submarines, missiles and equipment into an effective deterrent force from the very beginning of the Polaris program. Since these men were not available, they would have to be trained and developed.

The key and controlling element in the entire FBM system was recognized early as the human one. This "personnel subsystem" was the individual in the man-machine complex who is required to operate and maintain the equipment at peak performance in order to satisfy the systems' deterrent mission. Since time was a tremendous constraint for the initial training of the first FBM Weapons and Navigation personnel as well as the personnel in other areas, handpicked seasoned submariners were detailed as the first Polaris sailors. Many of these first personnel had been

associated with the Navy's "Regulus" program. This program utilized a jet-propelled pilotless aircraft launched from and guided by submarines to its target. By utilizing these personnel, the transition to a ballistic missile system could be made faster and more effectively. Nevertheless, a training program was begun even as the ships' equipment was being designed and built to insure that there would be sufficient numbers of men trained and ready to man the first operational FBM submarines.

The Navy, in 1957, really did not have a missile system training capability. There were no schools or organizations ready to develop and coordinate such a training capability. In addition, there was very little "in-house" knowledge concerning the complicated missile fire control, guidance, launching and navigation systems that would be required in order to implement a training program. Not enough time was available to permit the Navy to develop this "in-house" capability to train Polaris weapons personnel to the level required to operate and maintain the complex weapons system. Therefore, the handpicked, seasoned submariners were detailed to attend so-called "factory training courses" at the contractors plants and sites where the various weapons equipments were being developed, fabricated, assembled and tested.

Many of the early personnel gained their experience in the system by working with engineers and technicians while the equipment was being designed, built and tested. By early 1959, most of the major equipment contractors had acquired a basic

"in-house" capability on their particular part of the system and had organized training courses on a more formal basis. Still, in many cases, the learning and teaching process was combined with both instructors and students learning together from preliminary drawings and manuals.

Early in this period, it became apparent that the personnel undergoing factory training did not have a sufficient background in the space-age applications of electronics. This made it difficult for them to assimilate the level of information needed to operate and maintain the complex equipment properly. The student needed a basic understanding of electronics, computers, solid-state circuitry, Boolean algebra, rocket propulsion, inertial guidance principles and physics.

Since the factory training courses were predicated on the assumption that the student had this background, it was necessary that the Navy develop a basic course that could fulfill this requirement. Facilities were available at the Guided Missile School, Dam Neck, Virginia, and in mid-1959, the first Special Technology course, covering the basics of missilery listed above, was convened at the Guided Missiles School. In addition, a short introductory course to the entire weapons system was also developed. This marked the beginning of the development of an extensive training facility to be located at the Guided Missile School.

The organization available to plan, develop, coordinate and implement the training requirements during this period was relatively simple and basic. It consisted of a few people at the Special Projects Office, the Bureau of Naval Personnel and representatives of the Atlantic Fleet Submarine Force. As the various training requirements developed, this small and flexible organization would contact the various contractors, often by telephone or through personal visits, briefly outline the requirements, obtain the contractor's commitment, and then follow-up with the necessary paper work. Although this procedure was extremely responsive to the needs of the FBM program, it often was not the most effective or economical.

However, the main constraint was time and very little time was available for detailed planning of training courses and procedures. The training requirements often became known only after personnel had attended a course and discovered that they either did not receive the proper training or enough of it. Supplementary courses would then be quickly organized and conducted in an attempt to fill the knowledge gaps discovered. The dynamic nature of the program also made it extremely difficult to develop standard curricula because equipment design, principles, configurations, capabilities and operating characteristics were often changing on a daily basis.

The pressure to deliver the equipment to the submarine building site often made it difficult for the contractor training

personnel to permit the students to study and operate the various equipment at the contractor's plants. The contractor's engineers and technicians were working on the equipment on a 24-hour basis in order to meet tight delivery schedules. This often made it impractical to permit the students to work and operate the equipment. This limitation defeated one of the purposes of conducting courses at the contractors' plants.

Another serious deficiency with the concept of factory training was the fact that each contractor could only instruct on his own particular equipment and could not effectively cover the interfaces, interconnections and interreactions between the various subsystems. This system information was vital to the technician and equipment operator if he was going to operate and maintain the system effectively. A malfunction in one subsystem could easily manifest itself in another subsystem, and, unless the operator understood the interrelationships between subsystems, he was at a loss as to how to correct the malfunction.

In late 1959 and early 1960, plans were initiated to centralize the initial training for Polaris technicians and officers at the Guided Missiles School at Dam Neck. Again, due to the press of time and to the rather loose nature of the planning and coordinating organization for training, many decisions were made regarding this training facility that proved inadequate. A study for the Special Projects Office, dated 11 October 1960, pointed out deficiencies in the Polaris Training program as existed at

that time.[1]

The study indicated that the need for maintenance training equipment was critical. Procurement of this equipment should have been initiated earlier to meet the increasing requirements to train Polaris maintenance technicians properly and adequately. The basic problem was the urgency of installing the equipment in a permanent school such as the Guided Missiles School. The problem of training crews properly was becoming acute at this time, because the program was expanding rapidly and the supply of experienced personnel that formed the handpicked crews of the first submarines was exhausted. These experienced personnel could cope with most of the shortcomings of factory training. The less experienced students could not overcome these shortcomings and, consequently, were not being adequately trained at the factory schools.

There was an urgent need for a more thorough and closely controlled training program than could be achieved with factory training. In some cases, as mentioned previously, the factory schools did not have the equipment available for training. This permitted, in too many cases, the technician to report to his submarine without any equipment training whatsoever.

The fact that factory training was expensive was another problem that was brought to light in this study. The following were

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[1]Department of the Navy, Special Projects Office, Polaris Training Requirements, (SPO, 11 Oct. 1960), p. 1-3.

cited as the BuPers contract training and Temporary Additional Duty dollar costs per average student week:[2]

	Navigation Technician	Missile Technician	Fire Control Technician	MTRE Technician
Contract Cost	$363	$400	$230	$240
Per Diem and Travel	$104	$103	$103	$103
Total/Student Week	$467	$503	$333	$343

The cost for the same training, if provided at a Navy school, was estimated to be less than $80.00 per student week. It was obvious that a central Navy school was essential for purely economical reasons.

The fact that the frequent moves by the personnel to the various factory sites were detrimental to morale was another disadvantage of factory training. Personnel control was also poor and could have been maintained much easier at a Navy facility. The environment at a Navy facility is usually more conducive to the intensive study required during advanced training.

The quality control of the various courses was also difficult to maintain due to the geographic dispersal of the factory sites and the fact that control of the course content itself was weak. This quality control was essential in order to produce a properly and uniformly trained technician.

There was no longer a question, therefore, about the

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[2] *Ibid.*, p. 4.

demonstrated requirements for a Navy Polaris school. It became a problem on how best to go about getting this school and staffing it in time to meet the increasing needs of the expanding Polaris program.

The question of time was again paramount. In October 1960, under the existing funding and installation plans, it was realized that only half of the crews for the 41 submarines and their supporting activities would receive initial training on actual equipment at the Guided Missiles School. The initial training requirements of the program could not be met unless definite action was taken to increase the training capabilities at GMS as soon as possible by the establishment of higher equipment and installation priorities and by advanced funding. The alternatives were either a slow-down on the Ready-for-Sea schedules for the FBM submarines due to lack of properly trained crews or the acceptance of a reduced level of readiness that would result from utilizing inadequately trained technicians. The first alternative was unacceptable due to overriding national requirements. The latter alternative, although undesirable, had to be accepted. Even with increased equipment procurement and installation priorities, the advanced funding could not buy the time that had been lost due to inadequate forward planning.

Fortunately for the program, the caliber and dedication of the personnel assigned to FBM activities remained high. In addition, the personnel after reporting to their activity during the

construction and testing periods, became deeply involved in this testing program and gained additional experience and knowledge about the systems. In spite of the fact that their training had definite shortcomings, their knowledge of the equipment and the systems was often better than that of the people who were supposed to install and test the equipment on board the ship. The Navy personnel gained much needed knowledge and experience and materially assisted in maintaining the testing on schedule by working with shipyard personnel.

The need for fully pre-trained crews had made it necessary for the Polaris program to depart from the traditional Navy practice of providing basic instruction in a particular area in a Class "A" school and then training the man on the job after he reported to his ship or activity. Polaris required a fully trained crew because of the high level of readiness needed and the limited shipboard training opportunities available. The readiness level required to permit the submarine to launch missiles within fifteen minutes after receiving the order, allows little time for novices to gain experience in finding and correcting malfunctions. The hazard of inexperienced personnel injecting more errors into the system while troubleshooting malfunctions is ever-present and could not be accepted.

The design of the FBM system components for modular maintenance facilitates the replacement and repair of defective modules. These features were built into the system to minimize

shipboard repair requirements and to permit the rapid replacement of malfunctioning components thereby increasing system reliability.

The most vital element influencing this reliability, once the submarine departs on patrol, is the man who can detect, localize, eliminate or compensate for any malfunction. Thus, the maintenance technician is primarily a diagnostician and only incidentally a repairman. This made the term "maintenance" training misleading as it commonly denotes training required to repair faulty items. Feedback from the first crews, both prior to and after their first patrol, indicated that over 59 per cent of the problems encountered were system problems. It was necessary to train the technician to understand and diagnose these system problems. No training to develop the ability to analyze and to locate system malfunctions was being provided. This ability was the critical skill required to insure the operational reliability of the system.

The Development of an FBM Training Philosophy

The realization of this system diagnostic capability training requirement, after the first five FBM crews and one tender crew had been trained, provided an increased impetus to resolve this glaring training deficiency and to review the overall training program. Plans were developed to incorporate system introduction and training into the training courses.

In addition, the method of determining training equipment

requirements was reviewed. This review considered several related factors in the determination of training equipment requirements and resulted in a more systematic allocation procedure. The fact that the students had to be trained on actual tactical equipment in order to gain the experience needed was paramount in this allocation procedure.

The criterion adopted was that the curricula would specify 50 per cent classroom training and 50 per cent equipment training. This criterion was already being utilized in other military training commands and in industry.

Another important consideration was the maximum number of students that could be effectively and safely trained at one time on one equipment. The compactness of the FBM equipment severly limited this number. BuPers established a maximum number of three students on navigation and four on fire control equipment. Then, by projecting the expected student load, it was possible to determine the number of equipments of various types that would be required.

This was all well and good, but the high cost and shortage of FBM equipment plus the shortage of space made it impractical to satisfy this requirement for peak student loading periods. The actual number of equipments to be procured and installed made it necessary to plan utilization of the equipment on a two-shift basis based on student loading after this load had stabilized. During peak periods, the utilization of the equipments

on three shifts would barely meet the requirements.

As a result of the study conducted in October 1960, the Special Projects Office, BuPers and the fleet commands finally formulated a set of guidelines for the establishment of an FBM maintenance training capability at the Guided Missile School. The guidelines adopted were as follows:[3]

1. Maintenance training can best be conducted on:

   a. Actual equipment of the same type and configuration that will be maintained by the technician once he reports on board the ship, and

   b. Equipment that is interconnected into a system such as is found on board ship.

2. The amount of equipment required for training depends on:

   a. The number of people that must be trained, and

   b. The manner in which these people will be trained.

3. The personnel requirements, that is the number to be trained, is determined on a fiscal-year basis through examination of:

   a. New crew personnel requirements which is determined by the number of new crews being formed in a fiscal year on the following basis:

      (1) The SSBN "Blue" crew is required on board at the Ready-for-Sea date minus ten months.

      (2) The SSBN "Gold" crew is required on board at

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[3] *Ibid.*, p. 5.

the Ready-for-Sea date minus seven months.

(3) The Submarine Tender crew is required on board at the Ready-for-Sea date minus six months.

b. Replacement personnel requirements which are determined by BuPers by applying empirical attrition factors to all billets based on:

(1) Fleet attrition experienced in the FBM forces.

(2) Sea-shore rotation losses.

(3) School losses.

4. The curriculum requirements are to be determined by BuPers as regards course length, content, presentation, methods and procedures and will be based on:

a. The FBM maintenance concept.

b. The experience gained in FBM factory training.

c. The experience gained with overall Navy training.

Once these guidelines had been formulated, the next logical step was to formalize the objectives of the initial FBM training program. The training objective was that every FBM technician should be competent to maintain the equipment for which he was responsible.[4] The curriculum was to be designed to satisfy the needs of the forces afloat, because the forces afloat could not accomplish this training objective. This was because each FBM patrol is made under wartime conditions which do not permit disabling equipment for training. FBM operating schedules do not

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[4] *Ibid.*, p. 6.

allow time for on-board maintenance training, and the lack of space aboard fleet units, particularly the SSBN's, precludes effective training.

Several factors had to be taken into consideration in order to formulate a curriculum that could satisfy the training objectives. These factors were as follows:

1. The experience level of the FBM trainee would decline rapidly. More than half of the future trainees would be strikers with no previous fleet duty.

2. The individual FBM equipments are highly complex and involved, but the equipments comprise an even more highly complex and involved system.

3. The relatively small number of technicians aboard an FBM submarine or tender makes it mandatory that each technician effectively pull his weight immediately after reporting aboard.

The curriculum characteristics that could satisfy the training objectives required that each trainee begin the course with a preliminary introduction in computer and inertial theory, that the curriculum be structured to permit 50 per cent classroom and 50 per cent laboratory time, that only a small number of technicians study on one equipment at one time and would stress the maintenance of the subsystem with which the trainee will be concerned after reporting to an FBM activity.

All of the above guidelines served to formalize, to some

extent, the training requirements and philosophy of the Polaris training program. However, the formulation of guidelines and their implementation are two entirely different things. Actually, the program remained in the "management by crisis" category untill early 1964 when the majority of equipments deemed necessary to conduct the training as outlined in the guidelines was finally installed and made operational. The success of the Polaris program was heavily dependent on the personnel who operated the systems. That those personnel effectively performed this mission and that training was conducted effectively was, up to early 1964, primarily due to the efforts and capabilities of the personnel involved and not the system utilized to plan and manage the training.

The training course contents and length was usually determined by the instructors at the Guided Missiles School based on their experience and knowledge of the systems with some assistance from the Operating Forces and BuPers. This procedure was not according to the guidelines provided, but since nobody else could or would provide a formal curriculum, the GMS instructors, by default, were required to prepare their own informal curricula. In early 1963, BuPers, at the insistence of the school and the fleet, assigned patrol-experienced personnel to the school as instructors. Patrol-experienced officers were assigned to supervise and coordinate the training in the weapons and navigation areas. This step was taken primarily due to fleet

complaints that the training provided at the school was not sufficiently oriented toward meeting the needs of the fleet.

Very little formal research had been conducted to determine exactly what the Polaris technician needed in the way of training prior to reporting aboard an operating unit. The assignment of experienced personnel from these operating units to the school was made in the hope that the experienced personnel could better determine what training was required and how it should be conducted. Fortunately, these people were given a relatively free hand in making these determinations, and the courses were revised to provide the operating units with a trained product who was better prepared to fulfill the demanding requirements of the Operating Forces.

In order to prepare a better and more uniformly trained technician, the writing and compiling of formal detailed curricula was also undertaken in late 1963. These curricula replaced the various lesson plans formulated by individual instructors. The different lesson plans for the conduct of the same courses had made it impossible to provide all the students with the same type, depth and amount of training. Standard curricula and lesson plans helped to insure that all students in the same course of instruction would receive the same training.

A shift in training philosophy also occurred due to the influx of patrol-experienced personnel into the training area. These personnel realized that in order to develop a good system

diagnostician, the concept of "maintenance training" as had been formulated by the 1960 study group was misleading. They believed that maintenance training well seasoned with operational training would produce a much better system diagnostician.

This realization led to the adoption of a watch-training concept during which the trainee would operate the equipment much like he would aboard the FBM unit. The student was required to perform all the routine system tests, operate the system in its various modes, locate malfunctions inserted by instructors, maintain the watch records as required on board an operating unit and respond effectively to any situation imposed by the instructors. After undergoing this type of training, the student was much better prepared to fulfill the objectives of the training program by being able to report to his unit and immediately start "pulling his weight".

It can be seen, therefore, that the problems encountered during the early phases of the FBM training program were considerable. The inputs to the program came from many different sources such as BuPers, Special Projects, the fleet, Polaris contractors and the Guided Missile School itself. The coordination of efforts between these various activities left much to be desired. A formal management system for the training program which could develop and implement long-range training plans and requirements did not really exist. "Management by crisis" was the rule rather than the exception.

In spite of these shortcomings, the training program was relatively successful in meeting its requirements. This was due, as previously stated, primarily to the efforts and capabilities of the individuals involved rather than the management system currently in effect. An additional factor that must not be overlooked was the fact that the Polaris program had top priority within the Navy for men, material and money. This top priority made "management by crisis" possible but at a much greater cost of men and materials than would have been required with an effective management system.

Since 1964, the Polaris training program has stabilized, and many of the problems encountered during its early stages have been resolved. The effectiveness of the program has improved consistently since its early days and is now as effective, if not more so, than the majority of the Navy's technical training programs. The relatively stable training requirements during the last four years have made it possible to introduce, on a systematic basis, minor refinements that have contributed to the effectiveness of the program. The utilization of more patrol-experienced personnel as instructors, the updating and refinement of curricula, the influx of patrol-experienced personnel in responsible management positions and the adoption of more realistic fleet evaluation and qualification programs all contributed to this improved level of effectiveness.

Although the effectiveness of the training program is high, the efficiency of the program has remained relatively low. The overriding tendency of the program managers to emphasize results or outputs of the program with insufficient attention to the utilization of the program inputs is the primary reason for this low efficiency. The high program priority for money, men and materials has served to foster this output orientation. Some of the inefficiencies that have resulted from this output orientation are as follows:

1. Personnel have been overtrained. This has resulted in increasing the number of personnel required. Training facility requirements are also increased. The productive utilization of personnel time is correspondingly reduced.

2. The inventory of trained personnel has not been efficiently utilized. Trained personnel have been assigned to duties not requiring their skills, because the program had at times, produced more trained personnel than could be utilized. In addition, the inventory of trained personnel has not been maintained in an up-to-date status thus providing the personnel detailers with erroneous detailing information.

3. Training facilities and instructors are not consistently utilized in an efficient manner. Inadequate advanced planning and slow responsiveness to changing requirements periodically overload training facilities thus lessening their effectiveness and, conversely, periodically allow them to be idle, thereby reducing

their efficiency.

4. Overtraining of personnel creates morale problems. Personnel who have been trained to a high skill level expect to utilize this skill when assigned to an operating unit. However, since this high skill level is not required and utilized, personnel are frustrated, motivation is reduced and morale is impaired.

It is readily apparent, therefore, in this day of increasing emphasis on both effectiveness and efficiency throughout the Department of Defense, that an increased level of efficiency must be achieved in the Polaris Training Program. Steps to achieve this increased level of efficiency have already been taken within the program. These procedures for increased efficiency while maintaining effectiveness will be discussed in the next chapter. In addition, additional procedures to improve both effectiveness and efficiency will be discussed.

CHAPTER IV

RECENT CHANGES IN TECHNICAL MANPOWER TRAINING PROGRAMS

The Effects of the Dillon Report

On 29 March 1962, the Secretary of the Navy initiated a review of the management of the Department of the Navy to appraise the effectiveness, responsiveness, and economy of the Navy and to recommend changes where improvements could be made.[1] This review, which comprised a total of twenty individual studies, was the most comprehensive review of the management processes and structure of the Department of the Navy since the early 1940's. The report, which was completed in December 1962 and published in February 1963, is commonly known as the "Dillon Report".

One of the major studies conducted in this management review was the Manpower Management Study. The report of this study stated that

> . . . perhaps one of the most critical areas in need of attention may be identified as the "human subsystem" in new weapons systems development. The processes of manpower planning and development have not kept pace with the Navy's research and development program. Emphasis . . . on the production of new hardware has far outstripped consideration of the human factors involved. Lost sight of is the fact that the major components of a system include not only the hardware, but the people, the environment in which the equipment and people function . . . . A system must be personnel feasible as well as technically, monetarily, and physically feasible. The omission of human feasibility in the Navy's development planning will produce new systems of a complexity which can outstrip the capabilities of the combat forces to use, operate, and maintain the systems. While . . . the Navy up to this point has been

[1] NAVEXOS P-2426A, op. cit., p. VII.

> able to adjust to the situation, the capability to improvise in the future to accommodate these situations will become progressively difficult. The major contributing factor to this problem seems to be lack of complete objectivity in the Navy's RDT&E planning system which fails to make adequate provision for the human or manpower element in new developments. A secondary contributing factor lies in the ineffective operation of the lead-bureau system in carrying through such plans that have taken the manpower aspects into consideration. Accordingly, it has been recommended . . . that the objectives of new weapons planning be clarified to specifically include provision for "human subsystem" development and that the responsibilities . . . be clarified to assure the execution or pursuit of these objectives.[2]

The Study Group also found that the responsibility for training--including planning, implementation, and support--was vested in many diverse organizations. The dispersion of training responsibility created considerable confusion, duplication, and dilution of the total training effort.[3] As a result of this study and in accordance with the recommendations of the "Dillon Report", the Chief of Naval Operations promulgated a revised policy designed to insure the effective coordination of personnel requirements and training program planning concurrently with equipment development and production. This revised policy provided the framework required to improve the technical manpower training programs.[4]

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[2] Ibid., Study 5, Vol. I., pp. 7-8

[3] Ibid., p. 9.

[4] Department of the Navy, Office of the Chief of Naval Operations, Coordination of Personnel Requirements and Training Program with Material Developments, OPNAV Instruction 1500. 8E, (Washington; DON, February 1964), p. 1.

This policy, in the form of an instruction stated that

. . . the complexity of new developments for the Navy and the urgent operational need for this material makes it mandatory that personnel trained in its installation and maintenance and skilled in its operation be available in time for its operational introduction. The lead time required for personnel procurement and training is as real and as demanding as that for development and procurement of the equipment itself. Furthermore, continuing provision for the training of replacement personnel is necessary. Development and implementation of personnel and training programs must be timed and closely coordinated with the development and procurement of weapons, equipments and systems. Close and continuing liaison and effective coordination between all agencies involved . . . is essential to obtain satisfactory results.[5]

The instruction went on to say

. . . information affecting total numbers of personnel, procurement of training equipment and media, and construction or modification of training facilities should be incorporated into the budget cycle at the earliest possible time prior to the operational introduction of the new system or equipment. Concurrently, action should be initiated to identify new knowledge and skills required which may, in turn, necessitate changes in the enlisted and officer structure, qualifications, classifications, training programs, and complements and allowances.[6]

The instruction further stated that

. . . to accomplish the appropriate planning for personnel manning and training, initial estimates are made in connection with the preparation of the Technical Development Plan . . . or other appropriate planning documents. . . . These estimates must be continually under review and revision consistent with the development of the material concerned. At a propitious stage in the development of the system, weapon, or equipment, a Training Plans Conference will be convened and a Training Plan will be prepared, to set forth the personnel and training requirements and the course of action to be undertaken to meet

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[5] Ibid., p. 2.

[6] Ibid.

> these requirements. . . . The participants at the Training Plans Conference will be responsible for bringing to the conference information in their areas of cognizance . . . that will permit the formulation of a Training Plan. . . . During the Training Plans Conference, consideration should be given to equipment presently installed at training facilities which can possibly be replaced as the result of the introduction of the new equipment. . . . The Navy Training Plan is the official plan to provide trained personnel for the equipment or system concerned. The Chief of Naval Personnel, as the Navy's Training Authority, is responsible . . . for [the] preparation and overseeing the execution of the plan and [the] coordination and preparation of required changes.[7]

Responsibilities of the various bureaus and offices of the Navy Department were outlined in detail when the Chief of Naval Operations promulgated the above policies. All agencies concerned with new systems and personnel were required to examine areas which had caused problems in the Polaris Training Program. One of the steps taken was to insure that initial production of training equipment was to be included in the initial procurement of equipment for the system.

The Developing Agency is now required to provide the Navy's Training Authority, the Chief of Naval Personnel, the opportunity to participate in matters relating to personnel and training in the preparation of Technical Development Plans and any changes that may affect the personnel area during the development of these plans. The Developing Agency is also required to convene a Training Plans Conference, wherever feasible, at least three years before a system or equipment is introduced into the fleet.

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[7]*Ibid.*, p. 3.

The Developing Agency must inform Bupers of the maintenance concept, the number of planned procurements and installations and a tentative priority of allocations prior to convening the Training Plans Conference. In addition, the Developing Agency is required to provide "training media" to BuPers in the form of technical documentation and draft technical manuals to support initial training. Follow-on documentation required to maintain training current with equipment configuration must also be provided in a timely manner.[8]

The Chief of Naval Personnel, as the Navy's Training Authority, is charged with the following responsibilities and duties:[9]

1. Participate in the preparation of the personnel and training aspects of Technical Development Plans.

2. Refine the preliminary personnel estimates and develop detailed qualifications for personnel and training requirements.

3. Determine the feasibility of supporting new equipment developments within the scope of the Navy's current and future personnel potential.

4. Prepare and update when necessary, a recommended Training Plan based on agreements reached at the Training Plans Conference.

5. Act as overall manager for the details of implementation and execution of the Training, institute corrective action

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[8] Ibid., p. 5.

[9] Ibid.

when necessary and coordinate the corrective measures of other Navy Bureaus and Offices.

6. Provide guidance for the implementation of a responsive reporting system necessary to maintain positive monitoring control of each Training Plan.

This instruction (OPNAV INST 1500.8E) provides adequate guidelines for the implementation of an effective and responsive management system designed to coordinate and implement the Navy's personnel needs effectively. It also provides for inputs to this management system by other activities such as the fleet and other material commands. One of the more significant requirements of this instruction is the requirement that a Project Officer be designated in each major Office or Bureau to assist in the development, coordination and implementation of each Training Plan. Among the Project Officer's responsibilities are the following:[10]

1. He shall acquire a knowledge of the equipment/system concerned in sufficient detail to insure that all training requirements are known and considered.

2. He shall prepare and promulgate information that is the responsibility of his organization.

3. He shall attend Training Plan Conferences prepared to represent the position of his organization regarding training and personnel.

4. He shall act as a coordinator within his organization

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[10] _Ibid._, p. 6.

for all matters concerning the particular Training Plan and as contact point for agencies external to his organization regarding the Training Plan.

5. He shall monitor and report the progress of training as set forth in the Training Plan and inform the responsible Project Managers of other activities of any problems, slippages or changes to the Training Plan.

This assignment of Project Officers has been instrumental in the development of a more effective management system designed to insure that the Navy's training requirements are met effectively and efficiently. The Polaris Training Program is under the cognizance of the BuPers Submarine Program Manager (Pers A41). He is responsible for all manpower resources (less Nuclear Power Personnel) assigned to submarines and submarine support activities. The Submarine Program Manager is responsible for the coordination and monitoring of the total BuPers effort in support of the Polaris Training Program. This responsibility includes the identification of specific problems, insuring that appropriate corrective action is defined and initiated and that status reports to top management within BuPers and other interested offices outside of the Bureau are prepared and submitted in a timely and accurate manner.[11]

The Submarine Program Manager is assisted by a project team

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[11]Department of the Navy, Bureau of Naval Personnel, Submarine Program Management Team (BuPers Departmental Notice 5400), (Washington: BuPers, 28 July 1966), p. 2.

composed of personnel from the various sections of the Bureau of Naval Personnel and other Navy activities. The team members are responsible for the effective implementation of plans and policies which support the training program within their area of responsibility, the timely reporting of present or anticipated difficulties to the Program Manager and any other special assignments required by the Program Manager and within their functional area.[12]

This Program Management Team has functioned more or less in accordance with the guidelines provided. The degree of coordination between team members and between the team and other Navy activities, however, has not developed to a level which insures effective program management. Problems of effective communications, qualification and quantification of requirements and results, and an inadequate staff for the Program Manager have reduced the effectiveness of this team.

In addition, a project oriented organization working across functional lines has not been accepted universally by the project team members. As a result, functional interests often override project interests and reduce the effectiveness of the project management team.

The small size of the Program Manager's staff makes it difficult for him to exercise the degree of control, coordination, and appraisal required to insure the effective operation of his

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[12] Ibid.

project team. Information, such as quantitative personnel inventory status, is interpreted differently by different team members due to the lack of definite inventory criteria.

Additional shortcomings of the program management team organization in the Polaris training area could be listed. However, the problems listed are believed sufficient to indicate that this management system has yet to produce the results expected after the adoption of the recommendations of the Dillon Report and the resultant organizational policies promulgated by the Chief of Naval Operations. True, the effectiveness of the training program has improved due to the adoption of this management concept. Its full potential will not be realized, however, until the program management concept is accepted by all concerned and strengthened to eliminate its present weaknesses.

The CAPRI System

While the Program Manager system was being adopted, it became apparent that it could not, by itself, solve all of the Navy's training problems. Even with clear lines of authority, responsibility and communications, the amount of information and the complexity of the systems involved made it almost physically impossible to plan, develop, coordinate, implement and monitor a Training Plan properly. It was realized that managers required management tools or an information system that could cope with the amount and complexity of the data that the manager needed in order to perform his task effectively.

The need for an effective management information system was recognized by an AdHoc group report submitted in June 1962 by Rear Admiral Monroe and reemphasized in the Dillon Report.[13] This group concluded that a definite need existed for a more systematic incorporation of personnel support information into the original planning documents of a weapons system. In addition, it cited the need for information assessing the impact of weapons system development modifications on personnel support requirements.[14] The Navy, therefore, had to take significant and productive steps toward the automation of an information system in order to provide firmer management control over personnel development.

A research team, under the direction of the BuPers New Developments Research Branch, conducted a detailed systems analysis study of the management of the enlisted personnel requirements to operate and maintain the complex weapons systems being introduced in the Navy.[15] The Polaris training program was used as a model for this study. The study demonstrated the feasibility of computerizing an information system that could significantly assist the program manager in the accomplishment of his manpower management functions.

An information system known as the Computerized Advanced

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[13] NAVEXOS P-2426A, op. cit., p. 112.

[14] C.R. Beck, "CAPRI and TIMMS Programs Offer Key to Personnel Planning". Armed Forces Management, (August, 1967), p. 20.

Personnel Requirements and Inventory Information System (CAPRI) resulted from this study. The original concept of CAPRI was a system to manage manpower functions throughout the life cycle of a new weapon or support system. This life cycle spans the period from the issuance of a General Operational Requirement (GOR) for a new system through the final retirement of the last operational model of the system.[16] The overall objective of the CAPRI system was to insure that at the time each unit of a weapons or support system becomes operational, its crew is fully trained and ready to operate it properly. The specific design objectives of the CAPRI system were as follows:[17]

1. The integration of BuPers planning, development and production of a personnel subsystem for each new weapons system introduced in the Navy.

2. The close and continuing coordination of the personnel subsystem planning with the overall new weapons system planning.

3. The summarization of the personnel subsystem development and production plans for all new weapons systems to provide more timely and accurate information on the total current and

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[15]E.A. Lynch, "Management Information Systems in Support of Manpower Planning" in W.N. Jessop, (Ed.). Manpower Planning, NATO Science Committee Conference Proceedings, (New York: American Elsevier Publishing Co., Inc., 1966), p. 129.

[16]Department of the Navy, Bureau of Naval Personnel, Personnel Research Division, The Operational CAPRI System, Vol. 1, Operations Research Inc., Silver Spring, Maryland, (November, 1964), p. 3.

[17]Beck, loc. cit.

anticipated billet requirements compared to the personnel inventory for these new systems.

4. The computerization of personnel and training requirements data to provide more current, detailed and meaningful data.

5. The computerization of the progress reporting on the status of the personnel development and production plan to provide personnel planners with more rapid and accurate progress information.

6. The establishment of a CAPRI/COST system to provide estimates of and control over costs of new weapons system personnel support.

7. The compatibility of the system with other Navy control systems such as PERT and with the organizational and functional responsibilities of CNO, the Navy Management Office, Material Commands and BuPers.

As previously stated, CAPRI was designed as a system to manage manpower functions throughout the life cycle (both the development and production phases) of a weapons or support system. Similarly, the life cycle of a personnel subsystem can be divided into two distinct phases of development and production. The former is the period between the issuance of a GOR for a new system and the establishment of the special schools which are to train the men to maintain and operate the new system. The production phase begins with the assignment of trainees to a Navy school and continues through the initial buildup of personnel to

man the system, the meeting of replacement personnel needs and ends when the system is phased out of service.

In order to carry out the management and control functions required in each of these phases effectively, two distinct CAPRI subsystems were proposed, the Network Planning and Analysis (NP&A) subsystem and the Billets and Inventory (B&I) subsystem.[18] The NP&A subsystem was directly concerned with the development phase and the B&I subsystem with both the development and production phases of the personnel subsystem life cycle.

The NP&A subsystem is essentially an adaptation of the Program Evaluation and Review Technique (PERT) to personnel program management functions. The interdependencies and interrelations of the efforts within BuPers and between BuPers and other activities, such as the Developing Agency, in the planning and developing of a personnel system can be depicted effectively by such a network technique. This technique identifies and defines each task required for the development of the personnel subsystem concurently with the hardware development. This facilitates the matching of personnel and hardware development milestones. Once the estimated time to achieve the tasks required for each milestone is determined, a total program schedule can be prepared.[19]

This data can be computerized to provide reports showing the required start and completion times for each task, the "critical

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[18] The Operational CAPRI System, op.cit., p. 3.

[19] Lynch, op. cit., p. 223.

path" through the network, and "slack" time available. The periodic updating of this data permits the plan to be modified as better or additional information becomes available. This updating, as well as other changes to the schedule, will be reflected automatically in a new computer generated management report showing the effect of these changes on the other activities in the network including the effect on the final project completion date.[20]

The periodic reporting system provided by the CAPRI (NP&A) planning subsystem can be used by the personnel program manager and his project team to review progress, to locate program areas requiring management decision and action, to pinpoint responsibility for this action and to provide information on the overall status of the program. Specific areas that require monitoring during this development phase are basic personnel research, personnel requirements, personnel selection, development of necessary curricula, training aids, manuals, equipment and facilities.[21]

The primary function of the CAPRI Billet and Inventory subsystem is to provide management information during the personnel subsystem production phase. The subsystem provides the current and projected personnel requirements status once the personnel billets for each weapons system has been determined. Modifications to these personnel requirements that result from changes to

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[20] Ibid.

[21] Ibid., p. 220.

installation schedules, number of installations, manning levels and personnel inventory levels are entered into the B&I subsystem periodically. As a result of this updating, shortages or overages of personnel are identified promptly and necessary action can be taken to correct these deficiencies. The B&I output reports provide the project team with information regarding personnel inventory exceptions, inventory utilization, expected current losses, computed loss factors and the required school inputs to satisfy the overall personnel requirements by billet.[22] It also permits the comparison of personnel training requirements with training school output capability indicating any necessary or feasible reprogramming actions.

The B&I subsystem can also generate inventory information on total functional categories as well as on specific weapons systems. This provides personnel planners with information relating to the impact of a new weapons system personnel requirements on a particular classification of enlisted personnel.[23] In addition, the system is flexible enough to permit the determination of personnel requirements before and after the weapons system becomes operational and on through its entire life.[24]

In summary, the CAPRI system for the management of technical manpower requirements assists the program manager in the basic management functions of planning, organizing, directing, measuring and controlling. The primary emphasis during the development

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[22] Ibid. [23] Ibid. [24] Beck, op. cit., p. 20.

phase of a program is on planning. During this phase, basically through the use of the CAPRI NP&A subsystem, objectives of the personnel subsystem are determined, various alternatives are formulated and examined and decisions are made as to what is required and how to achieve it within the available time and funding constraints.[25]

Once the production phase of the program is reached, the management emphasis shifts to maintaining an equilibrium between personnel or billet requirements and the efficient distribution of the available and trained inventory of personnel. This is accomplished with the CAPRI B&I subsystem. This subsystem performs specific measurements of the inventory and requirements variables and indicates where prompt and timely adjustments in the personnel pipeline flow should be made.[26]

A primary element of the CAPRI system design is the concept of a personnel program manager which superimposes a project management organization over a functional organization. This element of the CAPRI system parallels the CNO requirement for a personnel program manager.

CAPRI thus provides the information system that the program manager needs in order to coordinate and integrate effectively all the BuPers functions related to his particular program. The structure of this information system permits the application of the "management by exception" technique and helps to reduce the

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[25] Lynch, op. cit., p. 222. [26] Ibid.

manager's workload to a more manageable level. Conversely, the CAPRI system also provides information to the Developing Agency and to other commands involved in the program in order that they can support their part of the personnel subsystem requirements.

CAPRI was implemented in 1964 in some 25 developmental or semi-operational projects. Its emphasis, in these projects, was directed solely to the critical-skill technicians required to man the new weapons systems. In theory, the system was the answer to the majority of the personnel program manager's information needs.

Since that time, however, acceptance and utilization of the system has been relatively slow. For example, the system is utilized by the Submarine Program Manager but not by the majority of his "project team". The Enlisted Submariner Distribution Desk, Pers B2113, does not utilize CAPRI but uses another computerized inventory system. This results in a communication problem between the program manager and his project team, since the two systems often generate different inventory numbers. Both systems measure the same inventory, but the standards and interpretation of the numbers differ between Pers A and Pers B.[27]

As a result, training requirements projected by Pers A and Pers B are often poles apart. The reconciliation of the requirements then becomes an involved task. Once the numbers are reconciled, the necessity for immediate, inefficient and disruptive

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[27]Interview with LCDR Painter, Pers B2113-1, 18 January 1968.

changes to training schedules will often follow. These training schedule changes could have been avoided, or at least reduced, if a common or compatible information system had been utilized by all members of the project team.

Thus, even with the adoption of a program manager organizational concept and the adoption of an automated personnel information system designed to make it possible for the program manager to perform his task effectively and efficiently, the results of these systems have not been impressive.

A stronger committment to the program manager concept and the adoption of a uniform information system is required by BuPers before the full potential of this system can be realized. Whether or not this can be accomplished without additional pressure from top BuPers management or from the CNO/SecNav to force full compliance with CNO policies and uniformity of information systems is problematical.

The Polaris/Poseidon Training Schedule and Equipment Requirements

As has been stated previously, the training requirements for the Polaris program have been relatively stable since 1964. However, this period of stable requirements is destined to be short-lived. The conversion to Poseidon training while maintaining a Polaris training capability is scheduled to begin in early 1969. This partial conversion from Polaris to Poseidon will require an effort that will practically equal the magnitude of the original Polaris program. In essence, Poseidon will be a new weapons

system replacing approximately three-quarters of the present Polaris capability. Poseidon, for planning purposes, is being treated as a new weapons system and not as a modification of an existing system.

In order to prevent the reoccurance of the problems that occurred during the development of the initial Polaris training program, the Special Projects Office (SPO) Training Branch (SP15) has developed a computerized information system designed to solve or reduce training equipment problems. This computer program was developed with the intent of providing SPO equipment planners with the information required to keep them current with the scheduled SSBN overhauls and the equipment delivery and installation dates at the various training sites.[28]

The "Polaris/Poseidon Training Schedule and Equipments Requirements" (PPTSER) document was the end result of the computerized planning program. The PPTSER has provided program planners (personnel, equipment, and tactical) with rapid and accurate information concerning total program requirements and the ability to meet these requirements.

The basic source document for the PPTSER is the SPO System for Projection and Analysis (SPAN). This classified document, which is updated periodically, lists all the key program dates and requirements such as submarine overhaul dates and equipment modifications and availability schedules.

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[28]Department of the Navy, Bureau of Naval Personnel, PPTSER Program-Progress Report, (Washington: PRL, December, 1967), p. I.

The original PPTSER provided training equipment planners with excellent and timely information of training equipment requirements. However, as the Poseidon program was being developed, it became apparent that an expansion of the PPTSER to include student loading information would assist the personnel planner in preparing and scheduling conversion and replacement training courses for Poseidon while maintaining the required level of effort for Polaris.[29]

As a result of the PPTSER expansion, the student loading requirements at the Guided Missile School are provided on a weekly basis for each Navy Enlisted Classification Code (NEC), on a fiscal-year basis by NEC and total student loading on a weekly basis.[30] This information provides the personnel planners with greater visibility for long-range planning of instructional, personnel, and facilities requirements, since PPTSER is based on the SPAN document which is structured to conform to the DOD Five-Year Defense Plan (FYDP). FYDP is designed to coordinate long-range military planning with short-range budgeting and projects programs and their costs for five years with major military forces, such as Polaris/Poseidon, projected an additional three years. Thus training requirements, as stated in the SPAN document, can be projected for eight years through the use of the information provided by the PPTSER.

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[29] Ibid.

[30] Ibid., p. A-1.

This information has just become available to the training equipment planners in SPO and to the personnel planners in BuPers. Pers C-11 (the Instructional Standards and Materials Division of BuPers responsible for the direction and coordination of Navy schools conducting submarine training) uses this data in formulating the training requirements for its various Polaris/Poseidon training activities.

The irony of this system is that it duplicates, to a large extent, the information that can be provided by the CAPRI system. Therefore, even if the system functions efficiently, it further compounds the problem of trying to match and correlate the information being used by other BuPers divisions. Pers A41, (the Submarine Program Manager) uses CAPRI as its information system, Pers B2113 (The Submarine Program Enlisted Distribution Branch) uses the BuPers standard enlisted distribution report and Pers C-11 (The Submarine Program Instructional Standards and Materials Branch) uses PPTSER. All these information systems partially duplicate, overlap, and compensate each other. However, each system uses different variables and input factors with their outputs being different from one another.

Only one system, the CAPRI system, was designed specifically to handle the entire development and production phase of a technical manpower information system. The other two systems are more limited in scope although both can provide some useful information. Minor revisions of the CAPRI system would enable it to

provide all the information required by all activities concerned with a personnel training program. Unless this is done, the proliferation of information systems to provide management assistance will result in more confusion, uncertainty, duplication of effort, and inefficiency of the Polaris/Poseidon training program. This duplication of information systems, where one system could perform the task satisfactorily and also improve the efficiency and effectiveness of this training program, is one of the more serious weaknesses of the Polaris/Poseidon Training Program.

Before discussing how the organizational and informational structure for the Polaris/Poseidon Training Program could be improved, more basic questions have to be examined. These questions are: (1) how much and what type of training is really required for the proper operation and maintenance of technical equipment? and (2) how can this training objective be determined? This actually forms the basis of two of the essential elements of a training plan: (1) how long is the training pipeline? and (2) what output is required from this pipeline? These questions will be discussed in the next chapter.

CHAPTER V

TECHNICAL TRAINING COURSE REQUIREMENTS

Efficiency Criteria for Polaris Training Courses

A prevailing and compelling objective, common to the majority of military personnel planners, is "cost-effectiveness". Many organizational schemes and information systems have been developed, tested and implemented in order to realize this "cost-effectiveness" objective. During the last few years, the Polaris Training Program has relied heavily on the program manager to achieve its objective of adequate training at least cost. As has been indicated in previous chapters, the organization and information systems required to achieve the "cost-effectiveness" objectives are available. These systems are capable of providing the Navy with an effective Polaris Training Program if utilized properly.

An effective training management system, however, does not guarantee that efficiency will follow automatically in both the development and production phases of manpower training. For example, an effective management system designed to manage a training program for Polaris Submarine Fire Control Technicians is not efficient if the technicians are instructed on both Polaris and Minuteman Fire Control Systems. Although this example is somewhat exaggerated, it is intended to emphasize the point that specific objectives for each training course are required.

Once the specific objective of each technical course is determined, a systematic training course can be developed to satisfy these objectives. These course requirements or objectives are not

easy to determine. A statement such as "the training objective is to prepare a man to operate and maintain the Polaris Fire Control System effectively" is rather meaningless, although it does in fact set forth the proper objective. The basic question that remains to be answered by such a broad statement is "What kind and how much training is needed in order to meet the technical system requirements?"

The determination of these requirements could lead easily to a deep involvement in the field of behavioral science. It is not the intention of this paper to delve into this field to any appreciable degree. Rather, primary emphasis will be on the "what" of learning instead of "how" learning is acquired. Actually, there has been a large quantity of published research and field activity concerned with the behavioral aspects of military training. Experience leads to the hard conclusion, however, that its impact upon actual training practice has been somewhat marginal.[1] As a consequence, personnel program managers have often spent more time and attached more importance to the task of administering numbers of men entering and leaving training establishments in order to meet manning commitments than to the examination of the objectives, contents and effectiveness of the training courses themselves.[2]

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[1]D. Wallis, "The Technology of Military Training" in W.N. Jessop, (Ed). op. cit., p. 82.

[2]Ibid.

Basically, then, once a workable personnel management and management information system in support of manpower planning has been developed, certain variables relating to the training itself have to be determined. These variables are required as inputs to the overall plan in order to determine such things as the length of the training pipeline, how many students are needed in this pipeline, who can be assigned to this training, and how the effectiveness of this training is maintained while meeting "cost-effectiveness" criteria. The above can be expressed in a series of questions that the manpower planner must answer if the program manager is to have an effective and efficient training program. The questions are as follows:

1. What skill level is required before the technician can perform his operational tasks properly?

2. How long should it take the trainee to acquire this skill level provided that he meets a certain intellectual and skill level prior to undergoing training?

3. Do all trainees have to be exposed to the same depth and length of training?

4. How can uniform entrance criteria for advanced courses be established?

5. How can trainee performance be evaluated during and after completion of the training course?

6. How can the performance evaluation results be factored into the training courses to eliminate potential deficiencies?

7. How can proficiency be maintained after the technician completes his initial formal training?

8. How can proficiency be expanded to permit the technician to handle equipment modifications and procedural changes effectively after being assigned to an operating unit?

The above questions cover most of the variable factors that the personnel planner must answer in one form or another before an effective and efficient training program can be developed. The management systems developed to date have not provided satisfactory answers to these questions. It will be necessary to direct efforts outside the present manpower information systems before these questions can be answered satisfactorily. These answers, then, can be used as the necessary input variables for a manpower information system such as CAPRI. Actually, these questions have usually been answered in one form or another. The answers, however, were often based on inadequate data.

Very few attempts have been made to provide a more objective training course structure derived through the process of scientific inquiry. As a result, Polaris manpower resources have, at times, been utilized inefficiently. The courses have provided instruction at a level above that necessary for the trainee to accomplish his task and neglected areas of instruction that he should have received.

Situations occurred frequently where much of the training received by the trainee was not required for his particular future

assignment and neglected areas of training that he needed. An actual case will serve to exemplify this problem. In 1963, BuPers promulgated a rating change which specified that the Polaris would be the only program that would require a Missile Technician (MT) rate. Prior to this decision, the MT "A" school at GMS had provided both the submarine and surface forces with "A" school graduates. This basic course did not prepare the trainee designated to enter the Polaris training program adequately. Because of this inadequate background, particularly in basic computer and inertial theory, it was necessary to teach him these basic fundamentals prior to starting the Polaris Missile Technician course. This additional training required an eight-week instructional period.

When it was learned that the MT "A" school's output would be utilized exclusively by the Polaris program, a curriculum change which would improve the school's output was expected from BuPers. This change did not materialize. Therefore, the Guided Missile School's FBM Department took the initiative and formulated a new curriculum structured to provide the student with the basic fundamentals required for the more advanced Polaris missile courses. The school determined that the MT "A" courses could be shortened by the deletion of instructional material that was not required as a prerequisite for Polaris training. In addition, it was determined that the material contained in the eight-week introductory computer and inertial theory course could and should be included

in the basic MT "A" course.

The result was a proposal by the school to BuPers that a new curriculum be adopted. This curriculum combined the two courses into one basic course, eliminated extraneous material from the previous courses, produced a better qualified "A" school output and reduced the training time required from 32 to 22 weeks. This represented a ten-weeks-per-student savings. It also decreased instructor and facilities requirements. The proposal was accepted by BuPers, implemented by GMS, and improved the effectiveness and efficiency of that portion of the Polaris Training Program substantially. The foregoing example demonstrates that a systematic objective analysis of the technician's future tasks to determine the composition of training courses is necessary. Otherwise, inefficiencies in training and in the utilization of manpower resources will occur.

Although most Polaris courses appear successful in the achievement of present training objectives, there is a lack of direct relationship between course content and realistic job requirements or training objectives. This is exemplified, in some cases, by overemphasis of theoretical course content at the expense of practical instruction, the retention of traditional subject matter in a course as a matter of precedent or "nice to know" rather than on a basis of a demonstrated need and the volume of subject matter presented may be too great for reasonable comprehension and retention by students. Training personnel

generally recognize these problems and usually make continuing efforts toward the reappraisal of training course content in terms of increased orientation toward actual job requirements.[3] Despite these efforts, discrepancies exist in the courses between the training methods and the training objectives thereby reducing the effectiveness of the training and often increasing its cost.

One of the primary reasons for the existence of discrepancies between the training methods and the training objectives is that too often the training methods are generated from composites of past methods which seem to suit the new requirement. The conduct of a Job Task Analysis is a more systematic method of determining training objectives. The purpose of this analysis is to determine the types, numbers, and the sequence of duties that operators and maintenance personnel may be expected to perform on a system. The data developed from this Job Task Analysis can then be used to determine the number, knowledge and skill requirements for personnel who operate and maintain the system. The level of detail of this analysis varies significantly with the stage of system development and the amount of prior experience with similiar systems. Usually, detailed concepts of operator functions and actions can be estimated and deduced logically from a functional analysis of the system. However, maintenance personnel functions

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[3] Department of the Navy, Bureau of Naval Personnel, Personnel Research Laboratory, Polaris to Poseidon-Personnel and Training Implications, Report prepared by W.C. Fisher for the 17th FBM Training Conference, (Washington: PRL, 7 February, 1967), p. 15.

will depend, in large measure, upon the maintenance philosophy incorporated in the system design and is tied very closely to actual hardware. Preliminary determination of skills and technical knowledge required to perform tasks can be accomplished before and during the development of the tactical equipment design.

This information may not provide all the data required but will serve to design training courses better suited to meet the training objectives or requirements. All Job Task Analysis are conducted with a primary goal of using the data to design a training program which will provide activities with personnel who can do the job adequately and who can meet the required personnel performance standards much in the same way as the equipment is required to meet precise performance requirements.[4] Thus, an output requirement for training can be established and the training tailored to meet this requirement.

The Job Task Analysis process is a useful tool which helps to determine the skill level to which the trainee has to be instructed in order that he may perform his task properly. The determination of the subject matter, the amount of subject matter and the depth of instruction required helps to resolve the question about the time element needed to produce a trainee with an acceptable skill level.

Related to the above is another area which influences strongly the level, depth, and length of training courses. This question is whether or not all trainees should be exposed to the

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[4] Ibid., p. 17.

same amount of training. That is, would it be feasible and desirable to provide less training to the junior technician and more to the senior, more responsible technicians? This question presents the personnel planner with a difficult and involved decision. This decision would be even more difficult in the Polaris program where the stated training objective is that every man "pull his own weight" as soon as he reports to an operating unit.

Providing the junior technicians with less training than the senior technicians may seem incompatible with this objective. This is how the concept has been interpreted up to the present time. Is it really incompatible, however, with the training objectives? In order to answer this question, the personnel planner has to incorporate a functional training requirements rationale with the job task analysis in order to be able to determine the proper level of training. One possible way that this might be accomplished is to divide the various levels of instruction by functional training requirements. The various levels of instruction could be divided as follows:[5]

1. Background training-- this level of training is intended to provide the required background information and understanding that will enable the individual to understand better the total system.

2. Operation familiarization training-- this level of

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[5]*Ibid.*, p. 18.

training is intended to provide the individual with an appreciation of the problems incidental to the operation of equipments other than those for which he has primary responsibility.

3. Operator training-- this level of training is intended for the regular operator of the equipment. It includes detailed instructions and sufficient operational practice (preferably on real equipments) to provide the minimum level of proficiency needed to perform as a member of a crew.

4. Operator maintenance training and introduction to the theory of operation-- this training provides the individual with the skills and knowledge needed to perform the routine maintenance actions assigned to the operator of the equipment. The theory of operation of the equipment is covered in sufficient detail to enable the individual to understand how and why the equipment operates as it does.

5. Routine maintenance training and theory of operation-- this level of training includes all of the regularly scheduled preventive maintenance that must be performed by the rate concerned. Being routine, the steps in the maintenance procedures are usually described in the appropriate technical manuals but the work may involve the use of technical test equipments beyond the skill and ability of the non-technically trained operator.

6. Trouble-shooting and corrective maintenance and detailed theory of operation-- this level of training covers the type of

maintenance required to isolate defective units or elements that are not covered in the routine type of maintenance. The theory of operation covers all the elements of the equipment in detail including the circuits and elements within replaceable units.

This functional training division provides the personnel planner with a model that helps him determine the level of training required for each technician. It is based on a Job Task Analysis and on the expected degree of responsibility that each technician will be assigned. Obviously, if only one or two of these technicians are assigned to any particular activity, it may be necessary to train to a five or six functional level. If there are three or more technicians assigned to the same area, however, it is highly probable that some of the technicians may be trained to a lower level without decreasing the operational effectiveness of the unit. In this case, training to level three or four would be sufficient, with four the preferred level.

The Polaris Training program, with its refresher training sites for the off-patrol crews, is structured ideally to take advantage of assigning and training personnel by functional levels. After each patrol, the "off-crew" undergoes a seven-week refresher training period. This training period could be utilized to train individuals to a higher functional level. The time is already available to conduct this training, and, to a large extent, this time is utilized, at present, for this precise purpose.

Thus, it is well within present capabilities to formalize this procedure and to utilize this period of refresher training as part of the total training program. Net savings of eight to fourteen training weeks per man could be realized if this system were adopted. The resultant decrease in the length of the training pipeline for technicians assigned to the FBM submarine weapons and navigation areas could decrease personnel inventory requirements by as many as 200 on an annual basis. This is more than the number required to man five crews with these personnel.

The foregoing proposal may very well cause many of the past and present FBM department heads and Commanding Officers to shudder and even insist that we cannot afford to cut down on training. Their reasoning may be that Polaris is one of the most complex systems yet developed and is required to operate on a continuous wartime footing. It demands, therefore, the most extensive and detailed of training programs. This reasoning has been pushed to the fore for the past eight years. Cries of anquish have been heard whenever it has been suggested that Polaris initial training was too detailed and extensive. Usually, they have suggested, and even insisted, that additional training time is required. Undoubtedly, this extensive training philosophy was valid during the early stages of the program. At that time, few people knew exactly what training was required in order to operate and maintain reliably a system under the conditions imposed on Polaris. Today, these requirements are known and they are

demanding compared to what they were in the pre-Polaris days. The requirements are not as demanding as many would make them seem to be, however, and they can be supported more economically with a selective reduction of training time.

The fact that the majority of replacement personnel going in the Polaris weapons program are on their first enlistment is another factor that must be considered. Usually, this means that after the completion of the present extensive training courses, replacement personnel report aboard as the junior men in their assigned areas. They are, for the most part, obligated for at least six years of duty with more than a year already devoted to training. Usually, their first duties on board the FBM submarine are watch-standing duties with minor routine maintenance responsibilities. Both the watch-standing and routine maintenance responsibilities are carried out under the supervision of the more experienced personnel in the division.

Since the junior man is not required or expected, usually, to perform extensive maintenance, the skills that he acquired through extensive training are not utilized and are rapidly forgotten. As he gains more experience with the system and attends courses between patrols at the refresher training sites, his technical knowledge and skill are increased at the rate he needs to perform his duties as he advances in rate and responsibilities. He will absorb and retain this training better due to the increased opportunity to reenforce the learning process with practical experience.

By the time he completes his first Polaris duty tour, normally a period of three years, his skill level should be equivalent to the skill level he would have had with the more extensive initial training.

The above procedure, as mentioned previously, is suited particularly to the Polaris program with its two-crew concept and refresher training sites. It would be more difficult to apply to other Navy weapons systems where the two-crew concept, refresher training sites, and time are not available. The philosophy of determining actual requirements as they relate to both operational and maintenance billets is valid Navy-wide, however, and should be adhered to religiously in all training programs.

The establishment of a uniform entrance criterion prior to the trainee undertaking skill-level courses has been accomplished in the Polaris program. The Polaris Electronic "A" school, located at the Guided Missiles School, provides the same basic training for Electronic, Fire Control and Missile Technicians. This was possible because the basic requirements for the more advanced or "C" courses in these Polaris skill areas are almost identical. The integration of the ET, FT, and MT "A" schools into one Polaris Field Electronic (PFE) "A" school was first conceived in late 1963 by the staff personnel at the Guided Missiles School. It was not until several years later, however, that the concept was approved and implemented. The benefits derived from this "A"

school concept are as follows:

1. The basic training received by the students can be tailored specifically to prepare them for the more advanced Polaris training. This insures that all students begin the "C" school with the same background. This eliminated the requirement for the introductory course in computer and inertial theory that had been needed to bring all students to the same knowledge level.

2. It provides the personnel detailers with more flexibility in the assignment of personnel where they are needed. A graduate of this PFE "A" school can be assigned to either the ET, FT, or MT area. With the previous segregated school arrangement, he could be assigned only to the specific area that he had been trained for in the "A" school.

3. Training time and costs are reduced because course material not required specifically as a background for the more advanced Polaris "C" training has been eliminated.

Since more and more of the Navy's technicians require an electronic background with emphasis on computers, it is possible that more "A" schools could be integrated to realize the same benefits realized in the Polaris program. This integration might be somewhat more difficult to achieve in non-Polaris areas but is well within the realm of possibility.

In any training program, evaluation procedures are required to determine the effectiveness of the training. Two areas of

evaluation are required. One is the evaluation or testing of the trainee during the course of instruction, and the other is the evaluation of his performance after he reports to his duty station. These two evaluation areas are required to monitor the students progress during a course against a standard and to detect deficiencies in the training courses both during the student's instructional period and after he begins his shipboard duties. An analysis of these training deficiencies would provide the information or feedback required to effect the instructional methods or course content changes necessary to eliminate these deficiencies.

During the course of instruction, evaluation procedures should be related directly to training objectives. Tests should be comprehensive, requiring information from all phases of the course, rather than covering only the most recently completed instructional block. Greater emphasis and grading weight is required on performance tests which represent job activities better than written examinations do. In addition, the tests should focus upon distinguishing between those students above and below some established level of performance proficiency. "Criterion-referenced" rather than "norm-referenced" measures should be employed to determine the extent to which students are meeting performance standards.

Early identification of potential failures and the immediate application of remedial measures should be an integral part of the

evaluation program. Once the trainee has completed the course, the evaluation of his performance on the job and the assessment of the current effectiveness of the training course in meeting job requirements should be obtained regularly through an established feedback system from job environments.[6]

One of the problems associated with measuring performance both in school and on the job is the development and application of standard performance measures. A promising step in the development of these standard performance measures has been taken with the development of "Terminal Performance Objectives". These TPO's define the skills and knowledge required for the operation and maintenance of various equipments on board FBM submarines. They were developed to match the broadly defined philosophies of FBM submarine operation and maintenance. The TPO's specify personnel development requirements for the entire operation and maintenance task.[7]

These TPO's or standard performance tests, can be developed in conjunction with the conduct of a Job Task Analysis and provide a standard performance measure related directly to the task requirements. The utilization of these TPO's in school and on the job would help to insure that the required skill levels are achieved and, even more important, maintained after the student

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[6] Ibid., pp. 24-25.

[7] Department of the Navy, Bureau of Naval Personnel, PRL, Terminal Performance Objectives for Selected Poseidon Equipments, (PRL, November, 1967), Vol. I, p. 2.

completes school. This would form a closed loop between Job Task Analysis, Training and Performance Evaluation. This system of evaluation and feedback could and should be applied to any technical training area if the full potential for effective and efficient training is to be realized.

The technicians' proficiency level can be maintained and expanded after the completion of his initial training by the judicious application of on-the-job training, self-study and, in the case of the FBM submarine technicians, refresher training between patrols. The qualification programs developed by the Submarine Force Commanders and the conduct of periodic inspections also provides a high degree of incentive for the technician to maintain and improve his proficiency. The refresher training periods are an ideal vehicle during which information can be updated as necessary to cover recent changes and modifications to equipments and procedures. The FBM submarine technician does have tremendous advantage over his non-FBM contemporaries in this area.

The Development of a Technology of Training

Briefly, then, the design, construction and operation of training courses must be conducted in a systematic, technological manner in order to obtain the required output with the minimum input. As much care and expertise should be devoted to the planning, designing, constructing and operating of the modern technical training courses as is being expanded in the equipment and administration areas. The formal equivalent to this care and expertise could be considered as the "Technology of Training".[8]

By necessity, this technology of training should be based firmly upon principles drawn from behavioral science. The utilization of proper technical procedures based on accepted behavioral science principles could assist materially in the achievement of an efficient as well as an effective training program. These proper technical procedures could be conducted in the following chronological order when planning training courses:[9]

1. Job Task Analysis or the breaking down of the total job for which training is necessary into constituent skilled activities. Unless and until an analysis of this kind is undertaken, there can be no expectation of building an adequate instructional system for any of the component tasks.

2. Declaration of training objectives phrased in precise

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[8] Wallis, op. cit., p. 108.

[9] Ibid., p. 94.

terms of the skill categories which were deemed relevant by the Job Task Analysis. In other words, the training objectives should leave no doubt as to exactly what a newly-trained man will be able to do.

3. The construction of criterion tests designed to measure periodically the progress of the trainee toward the accomplishment of the training objective and whether or not this progress is within prescribed limits.

4. Determination of the initial knowledge and abilities among trainees required for entry in a particular training course. This entails the setting of input "decision-rules" in order that the student inputs will be compatible with the output requirements. Clearly, no system can operate efficiently without setting limits on the inputs that it will accept.

5. Behavioral analysis which tells what a trainee has to do on the way to acquiring the required skill. More formally, it is the technique of interpolating between the input state of ignorance or ineptitude and the final output state of knowledge or skill. This interpolation can be viewed as the selection of a broad sequence of topics through which the training system will encourage the best accumulation of knowledge and skill.[10]

6. Construction and trial of the training course itself can now be accomplished. The course designer now assembles all the information he has gathered through the previous steps and knows

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[10] *Ibid.*, p. 99.

what his inputs and outputs will be as well as the intervening steps. Then he can allocate these functions among human and physical training means which could be instructor-oriented on one side or machine-oriented on the other. The emphasis should be on the selection of whatever combination of teaching media from available resources which will achieve the training objectives most effectively and efficiently.

7. Assessment of training effectiveness and efficiency by a terminal demonstration of acquired knowledge or skill during the course of instruction. Effectiveness can be assessed by the criterion tests developed in step three. The test results will serve to indicate whether or not the training objectives are being met. Efficiency, on the other hand, is basically the economic function of minimizing costs entailed in achieving and sustaining the training objectives. True costs, therefore, can be assessed only when the effectiveness of the system has been established.

8. Conservation of acquired knowledge and skill through programs of On-the-Job instruction, self-study and refresher training. This requires close coordination between personnel who are responsible for formal instruction at training centers and personnel who are charged with the responsibility of conserving and improving knowledge and skills in an operational environment. This is perhaps the most difficult step to achieve properly and is, consequently, one of the weakest areas in the entire instructional system. Until the fact is recognized that training does not and

should not cease after completion of a training course and until steps are taken to improve this area, training programs cannot achieve maximum effectiveness and efficiency.

The question arises, then, as to whether or not an "ideal" technical training course which will serve as a reliable vehicle for the accomplishment of the foregoing requirements can be designed. If this can be done, then the program manager will have a better guarantee that the variables-- such as course length, course content, input and output requirements and resource allocations will be valid and can be utilized properly by his information system.

Once these variables are determined reliably and maintained current, the program manager's task becomes largely one of administration of an instructional system. The instructional system has its built-in corrective and updating factors. It also has an information system designed to insure that a balance is maintained between billet requirements and the inventory of trained personnel.

Much research has been conducted in the design of an "ideal" training course. There are almost as many different designs as there are researchers and educational specialists. One such design is similiar to the general features of programmed learning materials.[11] The characteristics of this instructional system are

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[11] _Ibid._, p. 93.

as follows:[12]

1. The requirement for the clear and comprehensive statement of training objectives or the final output of the system.

2. The skills or information to be acquired is broken down into sequential steps, each building on its predecessor and capable of being handled in one cycle of the training process. The responses from each cycle is an intermedia e output of the training process and is an indicator of learning progress.

3. The development of a generalized sequence of instruction which is appropriate to the type of student involved. This sequence can be modified as the instruction proceeds for individual circumstances by the control permitted through feedback indications of the student's progress.

4. The provision for an effective method of eliciting and recording responses from the trainee throughout each cycle of instruction.

5. A method for the continuous comparison of actual learning with the learning that should occur during each cycle. Different methods can be used for this but they should be geared to inform the student of the results of this comparison at the earliest practical moment in order to realize the full benefit from the comparison.

6. The formulating of a built-in set of decision rules which

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[12] Ibid., pp. 92-93.

will indicate the necessity to provide the student with confirmatory or corrective "feedback" and to introduce new or remedial steps toward the system's objectives. Decision rules correspond to a "strategy" of instruction. An example of this might be to "continue presenting the same item until a satisfactory response is registered up to a maximum of four repititions. After four unsatisfactory responses, revert to the preceeding item".[13]

This, then, is one example of an instructional system which could be utilized for technical military training. Although this system is not offered as the final answer in the design of an instructional system, it is far more systematic and analytic than the systems utilized at present. If such a system accomplishes no more than to force responsible personnel to consider in a systematic manner, the requirements of a technical instructional system, an improvement in the effectiveness and efficiency of such a system should occur.

It is interesting to note that the problem of valid training objective determination and the implementation of training courses to satisfy these objectives is not limited to military training. The same problem exists in industry in such areas as plant maintenance training.[14] Some industrial activities have started to examine their training programs to determine how much unnecessary

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[13]Ibid., p. 93.

[14]J.J. Seidel, "Plant Maintenance Training", Training and Development Journal, Vol. 21, No. 12 (December, 1967), p. 18.

training is being conducted. The expenditure of training funds is being looked at systematically much like the expenditure of funds for plant and equipment. In addition, training is viewed as being valid only to the extent that the presented knowledge and skills are required and practiced in performing the work.[15] The equipment to be operated and maintained determines the knowledge and skills required which, in turn, is the one valid source for determination of training needs.

Here again, as in the military, there is a growing awareness of the need to determine training objectives, the end products of training. They are not the training itself, yet training course designers will often confuse the things they intend to do and course descriptions with training objectives. The idea is not to train just to be training but to achieve a terminal performance objective. The well known industrial necessity of "increased production" (more learning) at "decreased cost" (less teaching) is forcing industry to inspect and revise their training programs.[16]

The instructional methods and training course design advocated by some segments of industry as a result of this inspection, parallels closely the training program design described earlier. The exchange of information between the military and industry about this method of training course design could benefit both

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[15] Ibid.

[16] C.B. Off and L.D. Bouten, "Training Program Design", Training and Development Journal, Vol. 21, No. 8 (August, 1967), p. 21.

parties in the achievement of training effectiveness and efficiency. Military personnel planners, therefore, should not overlook this potential source of information, since the lessons learned by industry could assist significantly in the proper design of a technical training program.

CHAPTER VI

AN INTEGRATED TECHNICAL MANPOWER TRAINING PROGRAM

Polaris/Poseidon Training

Since its inception in the late 1950's, the Polaris Training Program has been an effective program. The fact that Polaris is considered as the heart of our nuclear deterrent capability and that the program has provided this capability on a highly reliable basis is well known and documented. The primary reason for this enviable record has been the men who have maintained and operated this system under wartime conditions. This fact is also well known and documented.

As we have seen in the previous chapters, the enviable reputation of the Polaris man-machine weapons system was not achieved without encountering and solving numerous problems. The effective marriage of man and machine, despite the many problems faced, is a living testimonial to the men who dedicated their time and effort to the program.

It would be highly presumptuous, however, to reflect on the accomplishments of the Polaris program without considering the methods which were utilized to achieve these accomplishments. The fact that the Polaris Training Program has achieved its objectives does not mean that we should be satisfied and continue the program as it has been conducted in the past. As has been noted previously, many of the decisions made during the course of the program were made on the basis of expediency with little or no consideration of the economic impact of the decision. In most cases, the

decision-maker had little or no choice in the matter and was concerned primarily with providing Polaris with trained personnel regardless of cost.

This philosophy of management, unfortunately, has a tendency to persist even when more efficient methods are available. Just because a system or procedure worked in the past does not mean that it is the best or only way to achieve an objective. A program management system has to be flexible and capable of adapting itself readily to changing conditions, requirements, situations and environments.

Polaris, in my opinion, is now at a crucial stage. Now is the time to review, in a systematic manner, all the aspects of Polaris training. This is necessary in order that the past level of effectiveness may be maintained and efficiency improved. An objective review should consider the management, information and training aspects of the Polaris Weapons System.

This review has considered only the major aspects of the program. During the course of the review, certain problems were discussed and possible solutions suggested. These problems and solutions are not meant or proposed as the only ones applicable. They are meant, rather, to provide a basis from which the problems germane to the program can be located, analyzed and solved effectively and efficiently.

The various proposals for the improvement of the Polaris Training Program can now be correlated into an integrated

management plan.

The present organizational system used to plan, control and monitor Polaris training is based on the project manager concept. This management concept has been practiced successfully in many fields of endeavor. The concept is well suited to managing programs which, by necessity, cut across standard organizational lines. Furthermore, this type of management system was recommended for the conduct of technical man-power training programs by the "Dillon Report", the Monroe "Ad Hoc" report and by the Chief of Naval Operations. The management of the entire Polaris program is based on this concept and was an important factor in the success of the program.

Technically, Polaris training is conducted under this management system. In actuality, however, the functional interests of the program management team often override the project interests. This is due, in part, to the lack of understanding of the project management concept by members of the management team, the lack of time on the part of some members of the team to participate to the extent required due to other duties, and the lack of expertise that would enable the team members to plan, control and evaluate the program in a more objective fashion.[1]

Many of the project team members have not been exposed to the basic concepts of teaching, learning and performance evaluation to

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[1]Interview with Captain F.T. King, BuPers Submarine Program Manager, Pers A41, 20 February 1968.

a sufficient degree. The effective management utilization of EDP systems is often not practiced due to the lack of understanding of the capabilities of this type of equipment.[2]

Many EDP systems have been tried and found wanting because of the lack of EDP systems knowledge. This has created the common impression that the systems were ineffective. EDP systems have proliferated as a result of the search for an "effective" system. This has generated more confusion rather than assisting the team in its management task.

The solution to the above problems is not easy nor can it be accomplished rapidly. On the other hand, the possible solutions must not be ignored or merely given lip service. In order to realize the benefits from and to avoid the pitfalls of a management system, the managers must have a good understanding of the "hows" and "whys" of the system.

This indicates one possible solution for the effective use of the program management concept by the Polaris Training Program management team. That is, all team members must understand not only the basic factors involved in training, but they also must know the management system being used to achieve this training. Once this is accomplished, the team members will have better success in using the present organizational setup to the programs's advantage.

The standardization of information systems in the Polaris

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[2]Ibid.

Training Program is another area that requires attention. The CAPRI system seems to meet the requirements better than any other system currently in use or planned. The system's effectiveness has been greatly reduced, however, by the lack of understanding of its capabilities, the need for better input variables and the failure to accept the system by all activities concerned with Polaris training.

The CAPRI system is not utilized to its full capabilities even in the areas where it has been implemented. The important CAPRI Network Planning and Analysis subsystem has not been used to any appreciable degree by the BuPers planning section because of the above difficulties.[3] The scope and complexity of the Polaris Training Program requires a responsive and flexible management information system. CAPRI was designed for this purpose and, although not perfect, could perform these functions if it was utilized properly and fully by the entire management team. The CAPRI Billets and Inventory subsystem can, over a period of time, assist in the statistical determination of the personnel replacement factors required to maintain a balance between billets and personnel qualified to fill these billets. These factors can be projected and modified as necessary to determine future personnel requirements.

Thus, the management system and a management information

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[3] Ibid.

system designed specifically for this type of training program are available. Stronger emphasis and better understanding is required in order that these systems can be implemented and utilized fully and properly.

A more systematic examination of the objective, contents and effectiveness of the training courses is required. The information generated by this objective examination is necessary in order to provide valid input variables to the information system in addition to improving both the effectiveness and efficiency of the training. The use of the Job Task Analysis procedure and Terminal Performance Objectives will help to determine these training objectives and course contents. The formulation of a "Technology of Training", such as outlined in Chapter V, also will help to improve training efficiency.

It is realized that the improvement of training efficiency cannot be accomplished overnight. It is, however, high time that the personnel planners take these procedures under active consideration and work toward their implementation.

This will require a basic change in Polaris training philosophy. The new training philosophy is not designed to produce an individual who is an expert in all aspects of the Polaris weapons system before reporting for duty. This is what we are trying to do at the present time. It will still produce a man, nevertheless, who "can pull his own weight" as soon as he reports for duty, and it can be accomplished with a much smaller expenditure of time and

money. The new training philosophy requires the inclusion of the "refresher training" period into the total training program. As stated previously, this "refresher training" capability provides a ready-built vehicle to improve training program efficiency and is unique to the Polaris program.

We have seen how the Polaris Training Program can be improved. This improvement is not so much in the area of program effectiveness but in program efficiency. The management system and the management information system recommended are already in use. Better utilization of these systems, however, is required. The basic concepts of training and a "Technology of Training" have been discussed and areas indicated that could benefit the Polaris Training Program.

These training concepts are not new or unduly sophisticated but could be and should be implemented in Polaris training. More efficient use of the present training capabilities can be accomplished if the "refresher training" period is included in the total training program.

The partial changeover from Polaris to Poseidon, starting in early 1969, provides the Navy's personnel planners with a ready made opportunity to apply lessons learned from past mistakes and to take advantage of a better management information system for the design and management of a training program. Indications are that steps are being taken in the right direction to implement the majority of the recommendations considered necessary for a better

training program. The recommendations discussed are feasible, and it is hoped that the process of implementation will be accelerated. It is the writer's belief that if this proposal or a similiar system is adopted and utilized properly, the Polaris/Poseidon man-machine complex will continue to maintain its high level of effectiveness with increased efficiency.

Applicability to Other Navy Technical Training Programs.

Discussion, in this paper, of the Navy's Technical Manpower Training Programs has been centered primarily on the Polaris/Poseidon program. In actuality, Polaris/Poseidon is a relatively small area of the total Navy technical training effort. Many of the problems encountered in the Polaris area, however, are not unique to Polaris. Similiar problems have been encountered in many other technical training programs. The solution or compensation for these deficiencies in non-Polaris areas has been, on the whole, more difficult, because these programs did not have as high a priority for men, materials and funds as Polaris did.

In addition to the priority advantage, Polaris has another advantage that often is not mentioned or considered. This advantage is the relatively stable scheduling of the SSBN operational patrols. Every "Blue" and "Gold" SSBN crew makes two patrols during a twelve-month period. The equally spaced patrols can be scheduled far into the future with little chance for any appreciable changes. The personnel rotation policies are structured to

permit the orderly rotation of approximately one-sixth of the crew after each patrol or about one-third of each crew per year. When a man reports to a SSBN, he can expect a three-year tour of duty before being transferred. In most cases, the personnel detailers insure that the individual has sufficient obligated service to serve a full tour before he is ordered aboard a Polaris submarine. The stable scheduling of patrols and the rotation policies in effect are conducive to maintaining a well trained and stabilized crew.

This luxury of stable scheduling of operational periods is not enjoyed by the majority of the Navy's non-Polaris activities. Personnel distribution policies for these activities are keyed to filling vacancies in the ships rather than providing well-trained stabilized crews.[4] In addition to the distribution of personnel, the Navy has not solved the problem of advanced training for people serving with the operating forces. If a key member of a crew is sent to an extended school, the ship must operate without his services during that period. The ship is faced with two unsatisfactory alternatives-- either do not send personnel to lengthy training courses or accept a lower degree of readiness brought about by personnel absences.[5]

In his article, "The Canadian Cyclic System", Captain Dombroff

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[4] Seymour Dombroff, Captain, U.S. Navy, "The Canadian Cyclic System", United States Naval Institute Proceedings, January 1968, p. 64.

[5] Ibid., p. 65

U.S. Navy, said:[6]

> By any criterion of effective use of men-machines in combination, our Navy is wasteful, even acknowledging the dubious rationale that military operations necessitate inefficient manpower practices.
>
> What, then, should we do? Essentially, we must schedule ships (and squadrons) to permit a progressive increase in training and readiness during the entire cycle between overhauls, and we must have stabilized crews that stay with the ships between overhauls.
>
> It can't be done? It has been done. The "in vivo" model-- the Canadian Cyclic System - is close at hand to study and to evaluate.
>
> The failure of the U.S. Navy to solve its manpower management problem may have resulted from relying on stop-gap solutions to piece-meal problems rather than finding-- as has the Canadian Navy-- a co-ordinated set of solutions which will make optimum use of both their people and the fighting units in which they serve.

The Canadian Cyclic System programs all Royal Canadian Navy ships and their crews for a period of sixteen months divided into four phases. Phase I is titled "Maintenance and Coursing" during which the ships undergo refits or overhauls and crew members attend training courses. New crew members report aboard during this period and personnel who have completed their shipboard tours are transferred.[7]

Phase II is the workup period which corresponds to the U.S. Navy's refresher training period. Phase III is the fleet phase when the ships are considered to be in the highest state of operational readiness. Phase IV is the "Personnel Assistance

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[6] *Ibid.*, p. 64.

[7] *Ibid.*, p. 67.

Phase" during which the ships are operated at a progressively decreasing tempo. During this phase, personnel are sent to schools which require more than seventeen weeks.[8]

After being in operation for three years, there is unanimous acclaim today in the Canadian Navy for the Cyclic System. The adoption of this system by the U.S. Navy would require major modifications because of our size, operational commitments and differences in lengths of obligated service for enlisted personnel. The potential rewards are such that the proposal should be given serious consideration.[9]

Viewed in this context, all the recommendations for improving both the management and training effectiveness and efficiency of the Polaris program could be applied to all other Navy technical training programs. Without the cyclic system, all the recommendations with the exception of those related to the "refresher training" periods are feasible Navy-wide and could be adopted.

The program manager concept and the CAPRI information system are already in use by other Navy Technical Training Programs such as the Anti-Submarine Warfare (ASW) program. The same problem of inadequate implementation and understanding of these management tools exists in these programs much the same manner as was found in the Polaris Program. The problem of coordination is more difficult in many of these areas because of the division of

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[8] Ibid.

[9] Ibid., p. 68.

responsibility between BuPers and the Developing Agency for initial training and follow-on training.[10]

An example will serve to illustrate this division of responsibility. The Naval Ships System Command (NavShips) has a Central Training Division (06T) which is responsible for training personnel for new systems until BuPers has established a training facility. Then the training responsibility shifts to BuPers. This means that the personnel planners in BuPers are not involved in the training of personnel for many of the new systems until several years after the training for this system has been initiated.[11] On the other hand, BuPers has full responsibility for the coordination of the Polaris training from the initial planning stage to the phasing-out of certain segments of the program.

The latter method permits more effective coordination of a training program and reduces the amount of redundancy necessary to plan and implement two different segments of a training plan. The problem of program continuity is eliminated and more expertise in the particular training area is generated. A single "Training Authority" can develop a more efficient training program.

The implementation of an Integrated Technical Manpower Training Program will be somewhat more difficult in the

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[10]Interview with Cdr. R.A. Hyde, U.S. Navy, BuPers Submarine Functional Training Branch, Pers C11, 25 January 1968.

[11]*Ibid*.

non-Polaris areas. This does not mean that such a program should not be considered. If the U.S. Navy is to use the cost-effectiveness technique as a method for determining military requirements, it must take advantage of every possible opportunity to improve its level of management sophistication. Technical manpower training is one of these opportunities that the Navy cannot afford to waste.

CHAPTER VII

SUMMARY AND CONCLUSION

During the course of this paper, the Navy's Technical Manpower Training Programs, particularly Polaris, have been examined. The effectiveness of Polaris training, despite many obstacles, has been proven beyond any doubts. The efficiency of the program, however, could be improved substantially.

The Polaris Training Program, like many of the other Navy technical manpower training programs, utilizes the program management concept. This managment system has demonstrated its effectiveness in many areas, both military and civilian. The full utilization and acceptance of the concept, an essential element if it is to work, has not been achieved due to problems of understanding, parochialism, and inadequate staffing. The solution to the above problems is obvious.

A management information system, which is an essential element for the management of a technical manpower training program, is available and in limited use. CAPRI was designed primarily for this type of training program and has the potential of being an effective management tool. As with the program management concept, it has yet to realize its full potential due to lack of understanding, the introduction of other management information systems, and inadequate input variables. Again, the solution to this problem is obvious.

The problem of relating training objectives to training courses is not so obvious. The best and most effective

management system and management information system will not achieve training efficiency if the training courses are not designed to produce an output that meets the needs of the operating forces. The Polaris Training Program has over compensated in its initial training courses because of the lack of specific training objectives. This has allowed Polaris training to remain highly effective but relatively inefficient. A systematic evaluation and determination of training requirements is needed and can be obtained through such prodecures as Job Task Analysis. The formulation of valid Terminal Performance Objectives can then supply the feedback data necessary to evaluate both the adequacy of the Job Task Analysis and the effectiveness of the training provided.

The feasibility and desirability of using the Polaris "refresher training" periods as part of the total training program is another avenue which could be used to improve efficiency without decreasing effectiveness. This luxury is not available in non-Polaris programs. This does not mean that a similiar type of "refresher training" period could not be achieved Navy-wide. The Canadian Navy's Cyclic System is, probably, the most promising system which could serve to make "refresher training" periods available to every Navy technical manpower training program.

Another potential problem area which Polaris has not had to surmount, but which other training programs have faced and are still facing, is the division of responsibility between BuPers and

the Developing Agency in formulating and conducting training for new weapons system. The shift of responsibility for the planning and conduct of training after the BuPers training activity becomes functional is somewhat akin to "changing horses in midstream."

In my opinion, this change of organizational responsibility during the initial stages of a training program is inefficient and decreases the effectiveness of the training. The recommended solution to this problem is to follow the Polaris example. In this case, the Developing Agency, the Special Projects Office, has a training section (SP15) charged with the responsibility of providing BuPers with the information required to develop a training plan. SP15 coordinates its activities with BuPers and assists BuPers throughout the life of a training program. BuPers, however, is the Training Authority with the final responsibility for the development, implementation, control and evaluation of all phases and aspects of the training plan. This organizational arrangement and responsibility for training has been effective for Polaris and could be implemented in other training programs thereby improving both training effectiveness and efficiency.

Briefly, the tools for Integrated Technical Manpower Training Programs are available. These are the Program Manager-type organization, the CAPRI manpower information system and a "Technology of Training" for the conduct of training. Additional work

is required in the scheduling area to permit the distribution of personnel to provide stable crews rather than filling vacancies in ships. The Canadian Cyclic System is a possible solution to this problem and certainly merits further consideration.

In closing, it must be mentioned that although training efficiency may have been stressed in this paper, training effectiveness is paramount. Once effectiveness is achieved and can be maintained, the achievement of efficiency is the next goal. Although both aspects of a program can be achieved concurrently, operational readiness of the fleet, the true measure of effectiveness, must remain as the primary objective of any training program.

Polaris has demonstrated that this high level of readiness can be achieved. Now, we must try to achieve and maintain a similiar readiness level throughout the Navy. The effective use of proper management techniques, information systems, organizational structures, training technologies and scheduling practices can serve to achieve this goal.

APPENDIX

EXPLANATION OF TERMS

BuPers: Bureau of Naval Personnel.

BuPers Operating Divisions (Pers A, B and C): Pers A is primarily concerned with the planning functions associated with the establishment of personnel requirements, Pers B with the distribution and assignment of personnel to fill these requirements and Pers C with the training of personnel in order that they may effectively fill these requirements.

Class "A" Schools/Courses: These school/courses are, in general, designed to provide the basic technical knowledge and skills required to prepare personnel for more advanced schooling or to perform limited tasks under supervision.

Class "B" Schools/Courses: These school/courses are designed to provide the advanced technical knowledge and skills required to prepare personnel for higher petty officer rates.

Class "C" Schools/Courses: These schools/courses are designed to provide training in a particular skill or technique required to operate and maintain a specific equipment or system.

Developing Agency: The Bureau or Office within the Department of the Navy with whom the Chief of Naval Operations has arranged for the development of a system or project and which has over-all technical control and budgeting responsibility for the development, test and evaluation of the system or designated project.

General Operational Requirement (GOR): A GOR states, in relatively broad but significant terms, the capabilities needed by the Navy within each functional warfare and support area.

Navy Training Plan: This is an official plan which provides planning information and assigns responsibilities to a specific training program and fleet introduction of new equipment or systems in order to provide trained personnel in time to man this equipment or system.

Polaris Refresher Training Schools/Courses: These schools/courses are designed to provide facilities and instruction in operational and refresher maintenance training for FBM crews while in overhaul or in an "off-crew" status which could not be profitably and adequately accomplished on board ships during an operational patrol.

RDT&E: The abbreviation applied to the process associated with Research, Development, Testing and Evaluation of new equipments and systems.

Specific Operational Requirement (SOR): SOR's state the need for a particular capability and outlines the system characteristics which describe what capability is to be achieved. It defines the performance throughout the system's operational environment and establishes the reliability, maintainability and personnel requirements.

Technical Development Plan: A comprehensive plan for the development and evaluation of a weapons or support system. This is designed to fulfill a Specific Operational Requirement and has been approved by the Chief of Naval Operations.

Training Media: Any item prepared or procured with the primary intent that it shall be used to train personnel.

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